The EUs understanding of Artificial Intelligence

In what way does the EU understand and regulate AI systems?

A critical Analysis of the EU AI strategies and regulations

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Abstract

This thesis explores the European Union's understanding and regulation of AI systems through a qualitative content analysis of various EU publications and documents. Based on the critical theoretical thoughts of Jaume-Palasi on the nature of AI systems two sub-questions are addressed: Firstly, to what extent does the EUs understanding of AI systems fulfill features of Infrastructure? Secondly, what infrastructure criteria does the EU fulfill in its understanding? The findings reveal that the EU comprehends AI systems with an infra-structural lens, recognizing their modularity, potential for both benefit and harm, common needs, and interdependent nature. Although the EU doesn't explicitly label AI systems as infrastructure, its understanding goes beyond mere technological innovation. Further, the EU´s understanding of AI systems aligns remarkably well with its own criteria for infrastructure. Emphasizing diverse participation, addressing biases, promoting retraining, and social access, fostering economic competition, ensuring safety, and supporting sustainability. Despite these findings, the thesis points out shortcomings such as the focus on the voluntary cooperation of companies and the inconsistent position of the EUs actors regarding real-time surveillance. Overall, this research contributes valuable insights into the EU's perspective on AI regulation, especially highlighting the importance of understanding AI as infrastructure.

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1 Introduction

1.1 Background

In the first five days after the 30th of November 2022, the AI Chatbot "ChatGPT" had reached over 1 million users. This is quicker than Instagram, the previous record holders in this category. Since then, AI tools of all kinds have reached the consciousness of the general public. The generative AI system “DALL-E 2” is able to create new images and art from textual input. The painting below was created by using only the following prompts: “A futuristic painting of the European Union's understanding and regulation of Artificial Intelligence Systems.”

Figure 1: AI Generated drawing as an attention grab

Source: Own / DALL-E 2

The applications seem endless and its effects can be expected to start a new Industrial Revolution. Since the first Industrial Revolution spread through Europe, technology has changed economic fundamentals and individual lives at a never-before-seen speed and radicalism. The introduction of the steam engine changed production mechanisms. With factories being built, humans started to work in shifts even at nighttime. With the

construction of railroads and electric grids, production was limited less on locality (Smil, 2005). A similar change in economic fundamentals and individual lives can be observed in this present era where the introduction of new technology is sparking the 3rd Industrial Revolution. The Internet of Things, 5G telecommunication technology, and the developments of Artificial Intelligence (AI) are all part of this revolution. As with every revolution, this will lead to massive changes in the Status Quo (Marchant et al., 2009). Workers might be replaced or under-skilled, and fake news might be created at an even faster pace and influence elections. Governments across the world are trying to shape and regulate these developments. One example is the Internet of Things which creates and collects massive amounts of data. Many daily-used devices, from the dishwasher to the car, are equipped with sensors and connected to the internet. Much more data is available and collected every day. This does not come without risk. Governments have stepped up and introduced different regulations, like the General Data Protection Regulation (GDPR) or the European Data Governance Act (Data Act), which are proposing how the downsides of technological innovation can be extenuated (Loo, 2018). The new emerging AI systems are up next for regulation. Effectively regulating AI gets increasingly urgent because AI development is speeding up and is already having far-reaching impacts on individual lives. A faked picture of Pope Francis, created by image-generative AI, went viral on social media platforms and had many confused if it was real or not (Ellery, 2023). Another example is AI systems that decide whether a candidate is eligible for financial support for a retraining program (Schwan, 2023). This has immense effects on individuals' lives. Since AI systems are developing rapidly, there is also a growing research gap in the knowledge about the regulation of AI (Dafoe, 2017). On the one hand, AI systems are developing at lightning speed and the first effects are reaching societies.

At the same moment, regulators struggle to keep up with these changes. Research by Corinne Cath and her team showed that governments have an increasing interest to create a "Good AI society", which puts the interests of society at the center of regulation, but governments lack a concrete strategy to do so (Cath et al., 2018). The European Union (EU) proposed a similar strategy called "human-centric AI" that intends to put human interest at the center of development and use emerging AI systems to solve social and ecological issues (European Commission, 2018). Beginning in 2018, the EU began its legislative procedure to create an AI

regulation Act. By creating the first comprehensive AI regulation in the world, the EU is entering *Neuland*. Therefore, academic research examining AI regulations, their constituents, and their impact is insufficient. A comparison study by Noordt et al. analyzing existing EU member states' government strategies shows a similar research gap (Noordt et al., 2020). The actors in question have a goal in sight, a "good AI society," but the policy tools to reach this goal remain unfinished. The approaches to regulating AI systems are varying, and a universal and best practice solution is not yet evident. Joining this debate is a new critical perspective on the nature of AI system regulations. In the article "Why We Are Failing to Understand the Societal Impact of Artificial Intelligence" by Lorena Jaume-Palasi, the author questions the status quo understanding and interpretation of AI systems by regulators. According to her analysis, AI systems should be understood as Infrastructure rather than a simple technological innovation. She argues that AI systems fulfill the features of roads or bridges rather than simple technologies like a combust-engine (Jaume-Palasi, 2019).

1.2 Research question

Following this school of thought, the impact of AI systems and technology must be assessed in the same way infrastructure is examined. This radical thought criticizes existing power structures and questions the status quo. This theory is not yet being applied to the example of regulation and is only an abstract theory. This bachelor thesis will take the first step and follow this new critical idea by examining the EUs understanding of AI systems from an infrastructure perspective. Therefore, the following research question is constructed:

In what way does the EU understand and regulate AI systems?

The existing EU framework and publications state that AI is considered a technological innovation. At the same moment, the publications go beyond simple technology regulation. The difference between the electric transmitter, a technology, and the electric grid, a type of infrastructure, is what functions it fulfills. These functions and the role of infrastructure in society will be extensively discussed in the theory section. To answer the research question, an analysis through a critical lens of official EU documents will be conducted and sub-

questions constructed. The first sub-question examines the question of which features of Infrastructure the EU uses in its publications.

To what extent does the EUs understanding of AI systems fulfill features of Infrastructure?

It is important to examine the EUs understanding of AI systems from the perspective of infrastructure features because it determines and constitutes the EUs choices in regulation. Regardless of whether this first sub-question can be answered positively or not, the EU's understanding should also be analyzed on its intended impact. The qualities and criteria that make infrastructure successful give a useful framework to analyze the intended impact of AI system regulations. Therefore a second sub-question is formulated:

What infrastructure criteria does the EU fulfill in its understanding?

The EU does not fail to mention its human-center AI approach. The criteria used to determine what makes Infrastructure successful also have a human-centered approach and therefore can be used to examine the EU understanding.

1.3 Research approach

For this research an interpretative approach is chosen. Using a qualitative content analysis textual data is analyzed in order to find evidence supporting or falsifying the research question. In the next chapter of this thesis the theoretical framework will be created. The framework focuses on a critical perspective of AI systems which attributes the AI system to the roles of Infrastructure. This chapter is followed by a methodological discussion that shows how research is conducted based on the theoretical framework and research objective. In this, the reasons for the choice of methods and data sets are given. In the analysis, the theoretical framework will be used to analyze the data sets and discuss the findings critically. In the conclusion, a brief discussion will lead to the answer of the research question.

2 Theoretical Approach

2.1 Introduction

The questions raised and to be answered in this paper are predicated on a critical theoretical approach. At its core, critical theory tries to question and discover existing power structures, social hierarchies, and dominant ideologies to uncover the underlying mechanisms which exist. Critical theory is inherently interdisciplinary, which is beneficial as this thesis also builds on concepts from political economics and sociology. This theory chapter will follow this school of thought and define the concept and features of Infrastructure. By using existing theoretical concepts a framework is build that can be used further.

This theoretical framework is strongly based on the groundwork of Lorena Jaume-Palasi and her article "Why We are Failing to understand the Societal Impact of Artificial Intelligence" (2019). Further, this chapter will give a short introduction to the EU and its policy-making process to give background to the choices made in the data selection and analysis. In the current status quo, governments understand and regulate AI in a purely technological manner. Governments try to protect individuals from harm caused by AI systems, like self-driving vehicles, by regulating travel to a particular speed in self-driving mode. This measure is put in place to ensure that any potential accidents are minimized, and thus protect individuals from direct harm (BMDV, 2021). Additionally, governments financially support companies with subsidies to accelerate research and innovation efforts.

Jaume-Palasai questions the nature of this kind of AI system regulation. AI systems do not only affect individuals directly but rather affect groups. An AI system categorizes data and then decides upon this base. In the self-driving car example, that could mean that the AI system controlling the car does not recognize children on the street because it has not been trained with that kind of data. Therefore, the AI system discriminates against all children and potentially causes harm to them. This makes AI systems different from other kinds of technological products, like an LED-Lamp or combust engine. This discriminatory effect inherent in the system is similar to the discriminatory effect that Infrastructure has. Instead of only harming individuals, infrastructure can also harm larger social groups composed of individuals. An example is the construction of bridges. Governments regulate and oversee the construction and the materials used so the bridge does not collapse. But further, governments

also consider the different impacts on different groups. Does the bridge have a bike lane that can be used by children that do not have a driver's license yet? The Southern State Parkway in New York was built with a clearance too low for buses to pass it. Therefore, individuals without a car, often marginalized black people, were unable to reach the other side and were uniquely deprived as a group (Kessler, 2021). Lorena Jaume-Palasi argues that AI systems have similar effects and therefore should be considered as Infrastructure.

2.2 Theories of Infrastructure

Infrastructure does not have one universal definition. The question of *what* is considered infrastructure and what is not, is still being debated in Political Economy and Public Administration. The following features and characteristics of infrastructure provide the theoretical framework for this thesis. First, it is important to be aware that there are different types of infrastructure. The common pictures of infrastructure are bridges, roads, and water sewage systems. This kind of infrastructure is considered hard or material infrastructure (Jochimsen, 1966). Next to that, there is soft infrastructure. Under this category, all other kinds of infrastructure can be summarized. Institutional infrastructure, like laws and regulations, government agencies or educational institutions. Personal Infrastructure, which describes humans and their skill sets. Cultural activities and social constructs can also be considered soft infrastructure (Jochimsen, 1966). All infrastructure, soft and hard, share the following features. They provide stability, are modular, interdependent and needed by the commons.

2.3 Features of Infrastructure

Infrastructure provides stability by allowing a systematical distribution of goods and services (Jaume-Palasi, 2019). A graspable example is the transportation of goods by trucks over roads and bridges. This comes also with the power to decide where and if the distribution of goods is possible. Which neighborhood has access to the road and which does not? Foucault conception of "Dispositif" can be used to define this feature of Infrastructure. Infrastructure as a tool that is used to exercise power over individuals or groups (Larroche, 2019). The power

to decide which group is able to use a bridge or which individuals are eligible for a credit is given to the individuals that control the design of infrastructure. Transferred to AI systems, this means also looking at the power dynamics involved in the creation of AI systems. Do the publications discuss who designs them? Can the public know what data sets are used and what groups are represented in those data sets? Who is able to exercise power within AI systems? Already AI systems are used to determine where police units are deployed to and exercise power (Douglas et al., 2021). All publications by the EU addressing this power dynamic and the question of the distribution of power can be the subject of examination.

The modular feature of infrastructure makes it scalable. Standardization and the breaking down of modules into smaller pieces leads to efficiency (Jaume-Palasi, 2019). One example is the constant voltage in an electric grid that is the same across regions in order to move electricity where it's needed. In soft infrastructure, this modularity can be observed in the form of bureaucratic steps that are broken up like applying for a construction permit at different agencies. Rightfully, there is critique and fear of abuse within this practice. The thinkers of the Frankfurter Schule make the point that only through the modularity of the bureaucracy the Shoa was possible (Horkheimer & Adorno, 1969). Infrastructure has been and can be abused. On highways, trucks can transport goods and create prosperity or tanks can be quickly moved to bring destruction. Modularity makes Infrastructure more susceptive if there is no awareness of the risk. For AI systems, modularity also creates these risks. Through the segmentation of responsibilities among too many actors, abusive practices might be possible and likely occur.

The common need for infrastructure is evident. Not every individual or company can build their own electric grid, highway system, judicial system, or school system. It would be not financeable neither does the space exist. Infrastructure is necessarily collectivist and serves the public instead of the few (Jaume-Palasi, 2019). This can be considered normative. Therefore the criteria of common need must be critically discussed in the context of neoliberal privatization. Privatized infrastructure serves the interest of profits instead of the common good (Peters, 2012). The creation of AI systems is similarly costly. To train them, massive amounts of data are needed, which are finite in practice. It is next to be discussed what the

collectivistic role of AI systems looks like. Especially in a neoliberal age where privatization is the rule rather than exception.

Infrastructure is interdependent. Infrastructure needs other infrastructure to function. As an example: In order to build a highway (hard infrastructure), planning, and permits from administrative institutions (soft infrastructure) are needed. Furthermore, to have functional administrative institutions, a functional education system is needed in order to have humans with the necessary skill set. Interdependence is not an *exclusive* feature of infrastructure. For example combustion engines rely on fossil fuels - interdependence is a *necessary and inherent* feature of infrastructure. Interdependent relations between different types of Infrastructure are part of the Modularity, Common Need, and Stability function of Infrastructure. Interdependence enables modularity and affects the power dynamic within Infrastructure (Jaume-Palasi, 2019). For AI systems, that could mean the existence of skilled workers, the existence of computing infrastructure, or the consolidation of existing laws and regulations.

2.4 Criteria of Infrastructure

The following methodology chapter will further discuss how these infrastructure features will be adopted to analyze the EU publications. Next to the features of infrastructure, the sub-question of the criteria was constructed. As seen above, infrastructure has distinctive features that make it unique. Because of these distinctive features, it is also useful to use different and unique criteria for infrastructure. If AI systems fulfill the features of infrastructure, it is interesting to use the EUs own criteria for infrastructure and analyze if it achieves its own standard. These criteria are based on the theoretical framework of the EU which provides best-practice advice for infrastructure. These criteria aim to balance social, ecological, economic, and cultural settings (European Commission, 2000). In the following section, the five main criteria: Social Needs and Access, Economic competition, Culture and Diversity, Safety, and Sustainability will be elaborated.

Social needs and Access assesses the degree to which infrastructure ensures fairness and accessibility for all members of society. Additionally, it should foster social cohesion. An example of this is institutional infrastructure, like standard final exams, that provide equal

access. Other criteria are the demographic data gaps, job training, or the gap between regions.

Economic Competition assesses the economic impact infrastructure has. Does it provide an equal economic chance, create fair competition, and balance the needs of employees and employers? Infrastructure that allows the movement of goods creates fair competition if it is accessible by all actors. Through investments, subsidies, and regulation, the impact of infrastructure on economic conditions can be directed.

Culture and Diversity assesses the effect infrastructure has on culture. Infrastructure should safeguard diversity and preserve existing cultures (European Commission, 2000). This includes the way members of society participate in the process. For example, the consideration and participation of ordinary members of society when building new railroad tracks. In AI systems, assessing culture and diversity is also about the awareness that data is not objective and can discriminate (Jaume-Palasi, 2019).

Safety in infrastructure assesses the possibility of causing direct bodily harm. Additionally, the capacity to provide safety for members of society by enabling defense and civil protection. In terms of AI systems, an example is the development of policing or military AI systems and the awareness of potential abuse of these systems for surveillance purposes.

Sustainability in Infrastructure is a criterion that assesses the impact on nature and the environment (European Commission, 2000). In the case of hard Infrastructure, this could mean that trees and natural habitats have to be cut down to build a highway. In terms of soft infrastructure, the degree of sustainability that is pushed for can be assessed.

2.5 Concluding remarks

In this chapter a framework describing the theoretical features of Infrastructure were developed. Connecting different theoretical backgrounds created a framework which now can be used further. The normative dimension of criteria was backed by a theoretical perspective and forms a second theoretical framework.

3 Methods

3.1 Introduction

At the beginning of this thesis, the research question was constructed that questioned the understanding of AI systems by the EU. This method chapter will explain the methodological foundation of this thesis. Using the previous created theoretical frameworks this chapter will transform these concepts into a practical framework that can be used for the analysis. The research design gives a general overview of the methodological approach. Next, the reasoning for the case selection of the EU will be given. Followed by the section explaining the data selection. This chapter will end with the method of data analysis in which the coding schema is elaborated.

3.2 Research Design

In order to answer the research question, information provided by textual documents have to be analyzed and interpreted. The research tradition followed is Interpretivism, therefore new knowledge is derived from the interpretation of texts (Riccucci, 2010). When working with legal texts there are different traditions on how to interpret the law (Möllers, 2019). Due to the fact that this is not a legal interpretation but a social science one there will be no differentiation between historical, systematic or teleological interpretation. Based on this extensive interpretivist approach the method of analysis is qualitative content analysis. A qualitative research approach instead of a quantitative research approach is a more fitting conceptual approach because to apply the theoretical framework sufficiently, interpretation of words and their meaning in a context is of importance. The research design is a case study of the EU. In the following case selection, this choice is justified.

3.3 Case Selection

The selection of the EU as the unit of analysis is based on three main reasons. The first and most important one is that the EU is the first governmental institution that proposes unitary legislation regulating AI. The EU does so with the legislative proposal of the AI Act. The second reason is that the EU has, according to Art. 294 Treaty on the Functioning of the European

Union (TFEU), the shared competence to regulate AI and is therefore the responsible actor. Third, the EU has shown that innovative regulation in fields that have not been regulated strictly before sets an example. This so-called "Brussels Effect" can be observed for example with the GDPR regulation that set the global standard in data privacy regulation (Bradford, 2021). The EU is a supranational organization comprised of currently 27 member states. In political fields that have shared or exclusive competencies, mainly areas that collide with the internal market, the EU can legislate new laws. The regulation of AI systems, as mentioned above, is considered one of these fields because it is expected to disrupt the internal market if every member state passes its own regulations. In the ordinary legislative procedure, all three legislative bodies are involved. The European Commission is the only legislative body that is able to initiate new legislation or propose directives. It is not elected by the citizens but chosen by the Council of the European Union and elected by the European Parliament. The European Parliament (EP) is the only direct representative legislative body of the EU. It participates in the law-making process by approving or rejecting legislative proposals of the European Commission. A new legislative proposal is usually discussed in one of the 20 committees of the European Parliament. In the committee's so-called "Rapporteur", members of the Parliament responsible for one specific legislative proposal, finalize the EPs position. Important and extensive legislative proposals can have multiple Rapporteurs and more than one committee can propose amendments. The third legislative body is the Council of the European Union. Every member state government is represented there by their Head of State or, in the case of specific policy fields, also by ministers. In both the EP and Council of the EU, there is a first and second reading. If the legislative proposal is adopted by both bodies without changes, it becomes law. If not, a trialogue between the EP, the Council of the EU, and the European Commission is started to find a common ground (European Parliament, n.d.). This is only a simplified theoretical conception of the ordinary legislative procedure. In practice, interest groups from non-profits to companies, media outlets, and regular citizens are involved in the legislative process. External feedback and advisory boards are usually involved in the creation of legislative proposals, so-called "White papers". Additionally, the role of each legislative body differs. The EP, as the only directly elected body, usually represents the interest of citizens more than the Council of the EU (Greenwood, 2017).

3.4 Data Collection

To answer the research question adequately, textual data by the European Union is needed. In the following, the documents to be analyzed will be elaborated upon in chronological order. In 2018, the Commission first published a Coordinated Plan on Artificial Intelligence that laid out a common strategy to tackle upcoming challenges and increase investments towards the research and development of new AI systems. The goal of this Coordinated Plan is to centralize efforts both from member states and the EU. In this Coordinated Plan, a High-Level Expert Group on Artificial Intelligence was established which published the "Ethical Guidelines for Trustworthy AI" in 2019. This expert group is composed of researchers, ethic experts, and industry experts that try to link the EUs interest in a human-centered AI approach with industry interests and technical conditions. The Commission simultaneously published a communication document called "Building Trust in Human-Centric Artificial Intelligence" that contextualized the Ethical Guidelines and recommendations. The High-Level Expert Group also published "Policy and Investment Recommendations for Trustworthy AI" in 2019. This focuses on expiditing the economic growth of AI companies and would have limited input for this thesis analysis. The next document published by the Commission in early 2020 is the European Strategy for Data. While this publication does not immediately deal with AI, it still contributes to the research objective of this thesis. Data is the foundation for most AI systems. Through data, many features of AI are enabled. Therefore, this communication of the European Commission will also be analyzed.

In 2021 the European Commission published a communication called "Fostering a European Approach to Artificial Intelligence". This publication updates the Coordinated Plan on Artificial Intelligence and was co-published with the first proposal of the harmonized rules on Artificial Intelligence (AI Act). The proposal of the AI Act is one of the core documents to be analyzed. As mentioned in the previous section, the Commission proposes a first draft of regulation before the Council of the EU and the EP add their amendments. The EP directed the proposed regulation to the Committee on the Internal Market and Consumer Protection and the Committee on Civil Liberties, Justice, and Home Affairs. In 2022, the committees published their first Draft Report with amendments to the AI Act. Due to the regulation being so comprehensive, five additional committees were asked to submit their opinions and amendments. The Committee on Culture and Education, Committee on Transport and

Tourism, Committee on Legal Affairs, Committee on Industry, Research and Energy, and Committee on the Environment, Public Health, and Food Safety published their opinions towards the AI Act. Those additional opinions are useful in order to sufficiently answer the research question because the committees explicitly discuss and suggest amendments in their field of expertise that get lost in the first draft report.

The last involved actor in the ordinary legislative is the Council of the EU. At the end of 2022, the Council published its General Approach to the AI Act. The list of documents is highly focused on official publications involved in the legislative process rather than speeches or individual actors' publications. Published strategies, regulations, and amendments are more precise and less susceptible for populistic statements. This choice is made in order to get more reliable results for the research question. The data collection ended on the first of June 2023, before the European Parliament and Council of the EU voted on the proposed AI Act with its suggested amendments. A full list of all documents, the authors, and their publication date is in the Appendix 1.

3.5 Method of Data Analysis

The method used for the data analysis is *Qualitative Content Analysis*. There are multiple approaches by different authors on how to exactly use qualitative content analysis, but the basic foundation stays the same. A well-done overview is given by Sage Encyclopedia: "Content analysis is the intellectual process of categorizing qualitative textual data into clusters of similar entities, or conceptual categories, to identify consistent patterns and relationships between variables or themes." (Given, 2008, p.120). Organizing and categorizing textual data into clusters of similar entities is exactly what this research aims to do. If the results are sufficient, relationships in the textual data become apparent and the research question can be answered. The conceptual schema inspired by Mayring (2014), Given (2008), and Palmquist (2016) are used to create a coding schema bringing together the best approaches to qualitative content analysis. The level of analysis is concepts. These concepts are based upon the theoretical framework and are created in the following. Based on the research objective two frameworks are created. In the following the reasoning and details are elaborated.

3.5.1 Framework of Features of Infrastructure

The first sub-question asks to examine the EU's understanding of Infrastructure features regarding AI systems. Based on the theoretical framework provided, the following categories and subcategories can be found. There are four features of Infrastructure, namely Modularity, Stability, Common Need, and Interdependency, which the documents will be analyzed for. To fully grasp the features, it is not enough to simply scan for keywords, but a deeper understanding of the texts is encouraged. The four features might occur alone or overlap in their existence in the texts. In Appendix 2.1 a detailed description of the concepts used is given.

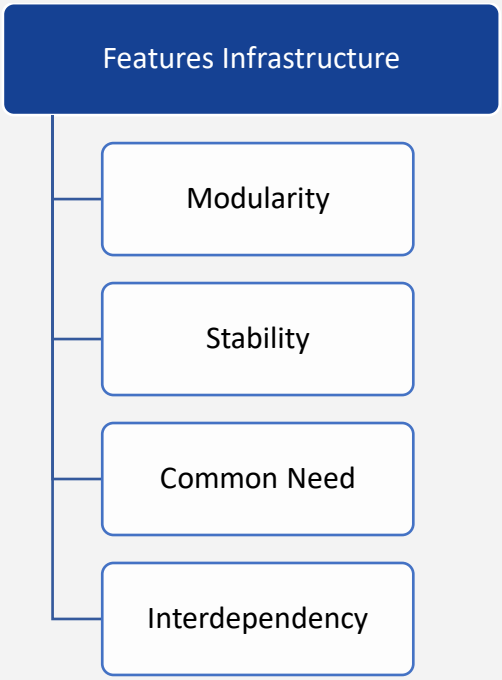

Figure 2: Overview Features of Infrastructure

Source: Own

3.5.2 Framework of Criteria of Infrastructure

The second sub-question to the research question relates to the criteria of Infrastructure. To answer the sub-question, sub-categories are created. Following the methodological concept of Saldaña (2013) the theoretical framework is used to further subdivide the categories into

sub-categories that reflect the content of the theoretical thoughts in relation to the research question. The categories are Social Needs and Access, Economic Competition, Culture, and Diversity, Safety, and Sustainability. They are further categorized into multiple sub-categories. For the category Social Needs and Access, five sub-categories, namely Education, Training, Job loss, EU Member state Gap, and Inclusion. The concept of Economic Competition has three sub-categories: Fair Competition, Economic Growth, and Investment. Culture and Diversity are subdivided into the sub-categories: Participation of People, Awareness: Discrimination, and Awareness: Effect on Culture. The category Safety got three sub-categories: Awareness: Abuse by Authorities, Military Development, and Police/Intelligence Developments. Sustainability has no sub-category because the implications of sustainability on AI systems and especially regulation are, as already argued in the theory section, expected to be limited. Included in this coding scheme are also keywords. This keyword list is incomplete and is open to be supplemented throughout the analysis. The coding scheme will not only look at the existence of keywords but also meaning, word sense, and synonyms. The full coding scheme is attached in Appendix 2.2.

Figure 3: Overview Criteria of Infrastructure

Source: Own

3.6 Research Tool

The research tool used in this thesis is the software "Atlas.Ti". This software allows one to analyze large amounts of textual data more easily. In comparison to an analysis done by hand, it also is more replicable, transparent, and therefore gives more reliable results (ATLAS.ti Scientific Software Development GmbH, 2023). The coding of the textual data can also be checked for errors more easily and lay a foundation to be used in further research.

3.7 Concluding remarks

Concluding, qualitative content analysis is the methodological approach chosen for this thesis. The case is the European Union due to its early and extensive regulation approach towards AI systems. The data was collected from all actors of the EU involved in the ordinary legislative procedure. To answer the research question and sub-questions, two coding schemes were constructed based on the features and criteria of infrastructure provided by the theoretical framework. Through the conception of features of Infrastructure, the coding schema was created. For the second sub-question, a second coding schema was created based on the criteria of infrastructure. In addition to the categories developed in the theoretical framework, sub-categories were created that enable more detailed analysis.

4 Analysis

4.1 Introduction

In the following chapter, the features and criteria of Infrastructure in the EUs understanding will be analyzed. Based on the earlier adopted coding scheme, documents from the European Commission, the European Parliament and the Council of the European Union will be closely examined. First, the features of infrastructure in the EU's understanding are contemplated. In the second step, the criteria of infrastructure in the EU's understanding are analyzed. The findings of the qualitative content analysis will be outlined with the help of key quotations, that showcase the understanding. This chapter is finished by interlinking the results of both analyses to answer the research question and discuss the findings in the conclusion.

4.2.1 EUs understanding of Modularity

The EUs understanding of features of infrastructure in AI systems is being examined based on an interpretation of mainly conceptional publications like the Coordinated Plan on AI, but also the proposed AI Act and suggested amendments. The aim is to interpret and therefore apprehend the EU's understanding and find all four categories of features of infrastructure.

The feature of modularity, the breaking down and standardization of AI systems, is of high importance. Through common standards infrastructure can be scalable and be used efficiently. The EU recognizes this and names it an important threat to the status quo of the single market: "The effective implementation of AI will require the completion of the Digital Single Market and its regulatory framework." (European Commission, 2018, p.3). This also means that the EU intends to build upon existing infrastructure, here the single market and its appendant regulations, and add another layer, the digital single market. This new layer consists of regulations like the GDPR, or the Data Act with the proposed AI Act complementing it (European Commission, 2018, p.7). Another aspect is its compatible nature. *"AI systems can be designed to operate with varying levels of autonomy and be used on a stand-alone basis or as a component of a product, irrespective of whether the system is physically integrated into the product (embedded) or serve the functionality of the product without being integrated therein (non-embedded)."* (European Commission, 2021b, p.19). This

understanding of AI systems implies that AI systems have a modular component to them. It functions depending on the environment it is used in. *"In particular, it is necessary to clarify that general-purpose AI systems are AI systems that are intended by the provider to perform generally applicable functions, such as image/speech recognition, and in a plurality of contexts."* (Council of the European Union, 2022, p.23). This is similar to a bridge that can function as infrastructure for individuals to get from A to B or function as an exclusive tool to deny access to the other side for certain groups by not adding bike lanes. In addition to the physical integration of AI systems, the intention behind integration is of relevance. The same AI systems which can be used for risk-free tasks might also be used in a different setting and pose a threat. (Council of the European Union, 2022, p.36). The possibility of AI systems being abused is neither unique nor special. Relevant is the recognition of the issue followed by adequate regulation.

This awareness by the EU connects to the concerns of the Frankfurter Schule and modularity. As stated before, the dilemma of modularity lies in the loss of responsibility – especially when it comes to critical infrastructure, in which failure might risk harm to individuals. Accountability needs to prevail. The EU recognizes this potential abuse and applies stricter regulations to high-risk AI systems such as those critical to digital infrastructure. This also includes AI systems that are used first in low-risk environments and then later used for high-risk applications (Council of the European Union, 2022, p.23). Regulations and standards do not just disable or enable certain objectives, but also advocate values and norms. The EU comprehends this by "*(…) contributing to relevant standardization activities in international standards development organizations to promote this vision.*" (European Commission, 2019, p.9). This approach is well known and has been used before with the implementation of the GDPR which created a global standard based on EU values. This global norm setting is called the Brussel effect (Bradford, 2021). In this case, a heavy focus on individual rights. It is only logical that the EU supports international standardization similar to its own. Many of the companies developing AI systems are based outside the EU and not in the scope of its laws. Additionally, selling AI products abroad also becomes easier with coherent regulation. It is important to notice that the process of standardization always goes along with the question of power. The ones creating standards are the ones deciding who gets what share of the profits, but also who is excluded.

4.2.2 EUs understanding of Stability

The infrastructure feature of stability is used to analyze this power dynamic. The awareness and consciousness of existing power exercises through AI systems is the core of the stability feature. The EU has a clear understanding of this: *"Trustworthy AI can improve individual flourishing and collective well-being by generating prosperity, value creation, and wealth maximization. It can contribute to achieving a fair society, by helping to increase citizens' health and wellbeing in ways that foster equality in the distribution of economic, social and political opportunities."* (High-Level Expert Group on Artificial Intelligence, 2019, p.11). This quote shows that the EU understands the distributive nature of AI systems. To achieve its own goal of a human-centered AI approach, the EU uses its authority to allocate power. This means potentially increasing the well-being of citizens and allowing for an inclusive use of AI. Distributing monetary value already in the production cycle leads to a more equal distribution of gains. On the other hand, wealth maximization is only helping the ones already possessing wealth. Unequal conditions are reinforced by this practice. Apart from the awareness of the potential, the question arises of how the EU can achieve human-centered AI. *"The Commission examined different policy options to achieve the general objective of the proposal, which is to ensure the proper functioning of the single market by creating the conditions for the development and use of trustworthy AI in the Union."* (European Commission, 2021b, p.9). The EU's understanding is that it has the competence to regulate the free market to have a functioning digital single market. Therefore, the EU is obligated to intervene in the market where necessary and may also restrict individual rights, like the freedom to conduct business. In the case of AI systems, the EU bans certain extremely high-risk AI systems completely. Like AI systems that explicitly exploit vulnerable groups, like children. (European Commission, 2021b, p.12). For other high-risk AI systems, the EU demands safety standards, transparency, and cooperation.

The proposed regulations are enforced through its member state and their institutions. This is due to the fact that the EU has limited abilities to enforce laws itself (Ioannidis, 2017). In addition, an AI Board is created which solves cases involving more than one member state (European Commission, 2021b, p.15). Cases impacting multiple member states are likely to occur because AI systems are often introduced to the whole EU single market instead of a

single member state. There is no unitary understanding of the compensation and competence of the AI Board. Importantly, the EP also encourages a quota for women on the AI Board and generally wants to have more political than simply technical representation (Committee on Industry, Research and Energy, 2022, p.11). The Council encourages a Board that will "*advise and assist the Commission and the Member States in order to facilitate the consistent and effective application of this Regulation*." (Council of the European Union, 2022, p.153). This is not contradictory to the position of the Parliament, but a different focus becomes evident.

Interestingly when it comes to the issue of initially reporting AI systems' impact, both sides agree. The AI Board, member states, and enforcement agencies can only act on cases that they are aware of. "*Companies are responsible for identifying the impact of their AI systems from the very start, as well as the norms their AI system ought to comply with to avert negative impacts.*" (High-Level Expert Group on Artificial Intelligence, 2019, p.23). Companies are the ones made responsible to identify the impact their AI system makes and therefore also which type of regulation applies. The EU does not fail to advocate for a human-centered approach to AI systems. On the other side, companies have an interest in creating maximum profits. Building a high-risk AI system and notifying the authorities is a disadvantage and not in the natural interest of for-profit companies. It is a reasonable concern that companies will downplay their AI system's impact to be less regulated. Similar behavior is already observed in data protection cases. Big tech companies are paying fines for breaking the law instead of complying with stricter regulations (Milmo & O'Carroll, 2023). Many of these tech companies are US based where the legal system follows a different legal approach. For a lawsuit to succeed the prosecution has to prove that the negative impacts were intentional (Simpson & Conner, 2021). This different approach is a further incentive for companies to ignore the rules. Surprisingly, the EP suggests that the creator of open source AI systems, which often are not profit-oriented companies, should get beneficial treatment (Committee on Legal Affairs, 2022, p.11). Apart from the findings for the feature stability, it is interesting to look at what things are not mentioned in the publications. The elephant in the room is the discrepancy between aspirations and reality. The EU exercised its regulative power to prevent harm instead of creating a framework to redistribute power. This results in scratching only the surface instead of addressing fundamental and structural problems.

4.2.3 EUs understanding of Common Need

The stability feature is closely connected to the feature of *Common Need*. As "*AI systems offer substantial potential (…) in the provision of public goods and services to society.*" (High-Level Expert Group on Artificial Intelligence, 2019, p. 13). This understanding used to describe the role of an AI system could easily be interchanged with the description of a railroad network and fits well into the theoretical framework of the feature Common Need. "*The AI systems increasingly being taken up in healthcare, farming, education, employment, infrastructure management, energy, transport and logistics, space, public services, security, climate change mitigation, and adaptation, can help to solve complex problems for the public good.* (European Commission, 2021a, p.37). The EU understands the central role AI systems have for other sectors to be successful. Many of these sectors also serve the public good, like education or healthcare. This is also a connection to the feature of modularity. Scalable AI systems can be used in numerous sectors and serve the common good more. Examples of this on the micro level are cancer screening which uses image recognition AI systems. On a larger scale AI system can create more efficient shift schedules and on an even larger scale they can allocate funds in a smart way to the hospital that is in the most desperate position. A common good approach is the only successful one due to the fact that large amounts of data are needed to train the AI system (European Commission, 2021a, p.54).

4.2.4 EUs understanding of Interdependency

It is not just AI system regulation that enables such developments but also other regulations, like the Data Act. This connects to the feature of interdependency. This feature is the awareness of the connection and dependency of different infrastructural systems with each other. "*Furthermore, the promotion of AI-driven innovation is closely linked to the Data Governance Act, the Open Data Directive, and other initiatives under the EU strategy for data, which will establish trusted mechanisms and services for the re-use, sharing and pooling of data that are essential for the development of data-driven AI models of high quality*." (European Commission, 2021b, p.6). The EU understands the strong interdependence on other forms of soft infrastructure, mainly regulations. For AI systems to function properly, other infrastructure needs to be available. This is not limited to legal infrastructure but also other soft infrastructure like skilled personnel, or hard infrastructure like the availability of

computing power to run AI systems on (European Commission, 2018, p. 2, p.6). The EU understands this essential feature of Interdependency clearly and even states that "*AI requires (…) infrastructure.*" (European Commission, 2018, p.7).

4.3 Interim conclusion

To answer the research question, publications by the EU were analyzed and the EU's understanding of the features of infrastructure were interpreted. To summarize, all four features, based on the theory section, were found. The EU understands the *Modularity* of AI systems and shows so by pushing for standardization and the creation of a common framework. Evidence for the feature of *Common Need* can also be found. The EU is aware of the need for common access to AI systems to enable other sectors to succeed. The understanding of the feature *Interdependency* supports these attempts by interconnecting different types of Infrastructure to enable AI systems to function. The EU's understanding of the *Stability* feature is arguable. While there is an understanding that it is the EU's duty as an institution to regulate AI systems, it does so half-heartedly. There is no unitary understanding of the different EU actors on which competencies the newly created AI Board should have or how it should be composed. There is also a gap between recognizing the issue of unequal power distribution and addressing it adequately. The EU prefers a regulation approach that trusts in voluntary compliance and cooperation. In the discussion section, these findings will be further elaborated and critically debated.

4.4 Introduction to EUs understanding of Criteria

In the first part of the analysis, a comprehensive analysis of the EU's understanding of the features of infrastructure was conducted. The second part will focus on the criteria of infrastructure and to what extent they can be found in the EUs understanding. The five categories with twelve subcategories are used to give an analytical framework to interpret the EUs publication. As mentioned before, criteria always have a normative nature to them. To ensure that the findings are reliable, a previously constructed coding scheme is used. The first part of the analysis ended with critical remarks about the EUs understanding of the feature of stability, the inherent power distribution dynamics, and the unclear unitary

position. Many of the criteria categories, like Economic Competition or Inclusion, are dealing with those issues and can be used to analyze in a more precise and in-depth way.

4.4.1 EUs perspective on Culture and Diversity

The criteria of Culture and Diversity have three subcategories of Participation, Awareness of Discrimination, and Awareness of the Effect on Culture. A general willingness to incorporate many actors in the process of developing AI systems and their regulation can be observed. *"Just like the work on ethical guidelines for AI, all these initiatives build on the close cooperation of all concerned stakeholders, Member States, industry, societal actors, and citizens.*" (European Commission, 2019, p.11). In the EUs understanding, it is essential that many diverse actors are able to participate in the creation of new regulations to succeed. The group of actors is not limited to companies, but also societal actors and citizens. It can be argued that societal actors and citizens are more likely to support the human-centered AI system approach instead of focusing on maximizing profits. The EP pushes for more participation of social actors and less involvement of companies. Their proposal goes as far as suggesting that in the process of impact assessment of high-risk AI systems, the "*Commission shall consult, where relevant, representatives of groups on which an AI system has an impact, industry, independent experts and civil society organizations*." (Committee on the Internal Market and Consumer Protection Committee on Civil Liberties, Justice and Home Affairs, 2022, p.102). Further, the re-establishment of the High-level Expert Group, which was initially created to provide the first ethical guidelines and background to AI systems, is pushed for by the EP (Committee on Legal Affairs, 2022, p.12). Individuals that are especially vulnerable to discrimination, like children or people with disabilities, should also get the opportunity to participate (Committee on Transport and Tourism, 2022, p.55). This would mean a shift from a dialogue between creators of AI systems and the EU to a trialogue between creators of AI systems, the EU and individuals affected by AI systems (European Commission, 2019, p.2).

The issue of Participation is closely linked to the issue of representation. This linkage gets particularly visible in the subcategory Awareness for Discrimination. "*The proposal complements existing Union law on non-discrimination with specific requirements that aim to minimize the risk of algorithmic discrimination, in particular in relation to the design and the*

quality of data sets used for the development of AI systems complemented with obligations for testing, risk management, documentation, and human oversight throughout the AI systems' lifecycle." (European Commission, 2021b, p.5). The EU understands the inherent discriminative nature of AI systems through algorithmic biases. There is an awareness that high-quality data sets and constant scrutinizing are needed to ensure a non-discriminative nature that respects existing Union law. The Awareness of Discrimination is separately mentioned by the Council and also the EP that pushes for a strict prohibition of any discriminative AI systems (Council of the European Union, 2022, p.39). The awareness of the effects on culture exists but in a limited matter. "*Those rights include the right to human dignity (…), protection of intellectual property rights, and ensuring cultural diversity.*" (Committee on Culture and Education, 2022, p.12). The EP suggests adding the category of cultural diversity to the potentially impacted fields. Again, there is a close linkage between awareness for discrimination, its effect on culture and participation. If civil society is excluded from the debate and the decision-making processes, the cultural impact might go unrecognized. An additional question that arises in the analysis is the conception of culture. Culture is a huge concept, from political culture to art and traditions to communication culture.

All these parts of culture have already been impacted by AI systems. Deep Fakes are used to spread fake news and algorithms decide what content is shown to the user (Duan et al., 2019). The understanding of the changes this brings to various types of culture exists rarely across all EU actors. One potential solution to those upcoming issues of representation and biases is to reflect the creation process of AI systems. The EU encourages "*putting in place oversight processes to analyze and address the system's purpose, constraints, requirements and decisions in a clear and transparent manner. Moreover, hiring from diverse backgrounds, cultures, and disciplines can ensure diversity of opinions and should be encouraged."* (High-Level Expert Group on Artificial Intelligence, 2019, p.20). Apart from counteracting potential biases in the creation process of AI systems, the EU encourages hiring a diverse staff that also represents the affected population and users.

4.4.2 EUs perspective on Social Access and Needs

This inclusion is also part of the next criteria *Social Access & Needs*. The social dimension of infrastructure is evaluated by subcategories that enable social access and account for the needs of all individuals. For the first subcategory, Education, the EU shows an understanding that "*the development and deployment of AI technologies, in addition to data and computational infrastructure, also require targeted actions and sufficient resources, focusing on excellence in research and innovation (R&I)*" (European Commission, 2021a, p.27). This is done by providing financial support through various programs. The EP goes even further and wants to exclude research and development efforts from the scope of the regulation (Committee on Industry, Research and Energy, 2022, p.7). This creates a unique advantage and encourages companies across the world to center their research and development projects in the EU. These examples show that Education is a criterion that is taken seriously by the EU and these efforts enable education and research activities to succeed.

Besides providing financial resources and limiting legal constraints, the EU is also aware of a need for skilled individuals. Through the subcategory Training in Job and Job Lose the potential risks but also opportunities are represented in the analysis. "*Communication, education and training play an important role, both to ensure that knowledge of the potential impact of AI systems is widespread, and to make people aware that they can participate in shaping the societal development*." (High-Level Expert Group on Artificial Intelligence, 2019, p.25). The general tone of the EU is to reduce negative impacts by thinking about the consequences as AI systems as they become more prevalent. Companies are encouraged to reskill and upskill their workforce rather than replace them (European Commission, 2018, p.14). The EP, once again, pushes for even stricter and more extensive regulation. Across all committees, the need for more digital skills among individuals is highlighted. The term "AI literacy" is introduced as a new skill set individuals gain to resolve the challenges AI systems can bring (Committee on Culture and Education, 2022, p.10). AI literacy can also be used to close the digital divide that exists within the European Union. The "*Digital transformation should occur in a harmonized manner across regions, paying particular attention to less digitally developed areas of the Union.*" (Committee on Transport and Tourism, 2022, p.6). The current situation excludes individuals without the necessary skill set. This group is likely to grow with the quicker development of AI systems.

The subcategory Inclusion is the criteria used for examining these issues. The EUs understanding of inclusion in AI systems is far-reaching. "*AI applications should empower citizens and respect their fundamental rights. They should aim to enhance people's abilities, not replace them, and also enable access by people with disabilities*." (European Commission, 2019, p.3). This understanding goes even further than inclusion. The empowerment of citizens goes beyond the negative freedom which is granted through fundamental rights in the EU treaties. Empowerment enables citizens to demand inclusion, access to (re)training and participation. Additionally, on a micro level, the criterion of Inclusion is dealing with individuals that deviate from the norm. An awareness that these individuals, like disabled persons, children, or minorities, are often excluded, exists.

In the EUs interpretation, special attention to reducing the risk of exclusion has to be implemented through additional regulation (European Commission, 2018, p.2). One example is the classification of "*AI systems intended to shape children's development through personalized education or cognitive or emotional development*" as high-risk systems, and therefore stricter rules apply. “ (Committee on the Internal Market and Consumer Protection Committee on Civil Liberties, Justice and Home Affairs, 2022, p.22). The central concept of human-centered AI, which the EU pushes so heavily, is based on a comprehensive inclusive dimension of the EU treaties. Through "*the fundamental rights and freedoms enshrined in the Treaties, the Charter, and international human rights law.*" AI systems should be regulated in an inclusive manner. Exclusion is related to inequality. Inequality exists on a micro level between individuals that get treated unfairly, but also on a macro level between member states.

This Member-State Gap is another criterion of Social Needs and Access. The EU is aware of the fragmentation in the European landscape that potentially increases with fast-developing AI systems and the effects on the single market (European Commission, 2020, p.7). While the data showing the divergence in member states does not exist yet for AI systems, a glimpse into the cloud usage is used by the EU to measure the gap. The gap is 55%, from 10% usage in businesses to 65% (European Commission, 2020, p.10). In the EUs understanding, this gap is closed by increasing investments in regions lagging behind (Committee on Industry, Research and Energy, 2022, p.5). Where the EU invests directly, e.g. through digital innovation hubs, a geographical balance is aimed for (European Commission, 2018, p.19). Interesting to

note is what cannot be found in the publications here. The EU doesn't create direct incentives or strict rules to close the gap. Member states which are lagging behind are not forced to invest in the AI/Tech sector to stay competitive in the single market. Neither are companies forced to invest across all regions of the EU, but they can cherry pick the best locations themselves.

4.4.3 EUs perspective on Economic Competition

As mentioned before, using economic leverage is important to succeed with the EUs idea of human-centered AI systems. The criterion of *Economic Competition* uses the subcategory Fair competition, Economic Growth and Investment. Ideally, AI systems, as Infrastructure, should create fair conditions and enable fair competition. "*Besides the high concentration in the provision of cloud services and data infrastructures, there are also market imbalances in relation to access to and use of data, for example when it comes to access to data by SMEs [Small and medium sized enterprises] (…) The high degree of market power resulting from the 'data advantage' can enable large players to set the rules on the platform and unilaterally impose conditions for access and use of data or, indeed, allow leveraging of such 'power advantage' when developing new services and expanding towards new markets.*" (European Commission, 2020, p.9). The EU is aware of the current existing imbalance between companies. Through de-facto monopolies on data sets, private infrastructure and human infrastructure, big companies create an unfair advantage. Because not many of these big players are EU-based firms, the EU wants to support SMEs in catching up. The EU does so through the implementation of regulations, like the Data Act and AI Act, that level the playing field in strategically important sectors, like health care (European Commission, 2018, p.25). In a globalized market, unfair competition does not end at borders. Governments across the world try to protect their national companies by creating trade barriers. The EU understands this and uses international institutions, like the World Trade Organisation, to implement international standards and address unfair trade barriers (European Commission, 2020, p.24).

Aside from external competition, there is an international market that not only needs fair competition but also incentives to develop human-centered AI. "*We now have an important window of opportunity to shape their [AI systems] development. (…) We also want producers*

of AI systems to get a competitive advantage by embedding Trustworthy AI in their products and services." (High-Level Expert Group on Artificial Intelligence, 2019, p.6). The EU aims to create a competitive advantage by having companies that use Trustworthy AI, a synonym for the later called human-centered AI. This is achieved through Investment. The EUs answer to the described challenges, from inclusion to closing the data bias, is to address them with investment and only in limited cases with strict regulation (10:8 p 2 in EC_Coordinated_Plan_on_Artificial_Intelligence_Plus_Annex.pdf). The EU has published multiple programs and initiatives to help European companies to succeed with this new technology. Establishing and financing Digital Innovation Hubs, which allow companies to test their products Further, loans and subsidies given through the EU recovery plan, which was implemented to restart the economy after the COVID-19 Pandemic, are relocated to "*measures fostering the digital transition*" (European Commission, 2021a, p.3). Around 20% of the EU recovery plan, about 130 billion Euros, will be spent on this (European Commission, 2021a). Unarguably, this is a lot of financial resources. It is up to other studies to debate if this amount is sufficient and compare it to other governments spending. Fiscal spending creates Economic Growth, which is another part of the Economic Competition criteria.

The EU appeals to its member states to create conditions for economic growth to the limitation of the EUs competencies and especially the issue that the EU is not able to collect taxes itself, it is dependent on the member states to support the economies (European Commission, 2021b, p.72). Interestingly, the EU is not interested in just any kind of economic growth, but especially encourages "*Green Growth*" (European Commission, 2021a, p.68). This follows the consistent tonus of all EU measurements. Human-centered AI systems contribute to solving key societal challenges, like the transition to a green economy, climate crisis, digitalization, exclusion, or inequality. There is also an understanding by the EU that "*artificial intelligence can contribute positively to the green transition but also has significant environmental impacts due to the critical raw material required to design and build its infrastructure and microprocessors and the energy used for its development, training, tuning and use.*" (Committee on Transport and Tourism, 2022, p.6).

4.4.4 EUs perspective on Sustainability

The EU's awareness of the criterion of *Sustainability* goes further than the knowledge about resource consumption. The development and operation of AI systems use resources but at the same moment, AI systems can also be used to increase efficiency and optimize existing systems to reduce resource consumption. The EU encourages these applications of AI systems by regulating these types less strictly (Committee on Industry, Research and Energy, 2022, p.5). Interestingly, the EP is the driving force in mentioning the sustainability aspect of AI systems. Of the 22 quotations for sustainability, 18 are in publications of the EP while only four are of the others.

4.4.5 EUs perspective on Safety

The last criterion is *Safety*. While usually in infrastructure assessment this criterion debates the direct safety effects, like the question if a bridge will collapse, the EUs understanding varies for safety in AI systems. In the previous parts of the feature Stability and the criteria of Social Needs, the direct safety effects were incidentally examined. The interpretation of the EUs publications is focusing on the security of individuals' rights and the regulation of policing and military developments. "*The use of AI systems for 'real-time' remote biometric identification of natural persons in publicly accessible spaces for the purpose of law enforcement is considered particularly intrusive in the rights and freedoms of the concerned persons, (…) and indirectly dissuade the exercise of the freedom of assembly and other fundamental rights.*" (Council of the European Union, 2022, p.26). The EU is aware of the potential that AI systems have when they are abused. Some usage of AI systems, like real-time identification by law enforcement or other authorities, can always infringe fundamental rights granted by the EU treaties. Logically, the EU prohibits this type of usage. Except "*where the use is strictly necessary to achieve a substantial public interest, the importance of which outweighs the risks.*" (European Commission, 2021b, p.27). A definition of what the EU understands under "substantial public interest" is not given. The decision falls on the member states. This position is controversial between the different EU actors. The EP opines that "*Such [real-time remote biometric identification] AI systems should therefore be prohibited*." (Committee on the Internal Market and Consumer Protection Committee on Civil Liberties, Justice and Home Affairs, 2022, p.16). While contradicting the Council supports exceptions

suggested by the Commission (Council of the European Union, 2022, p.4). This disagreement continues for almost all usage of AI systems by law enforcement authorities. The EP also discourages the use of predictive and profiling AI policing systems. While the Council does not see the necessity of additional regulation in this field. The method used for this analysis was qualitative content analysis. In order to fully understand and contextualize the different positions of the actors a critical discourse analysis would have been more fitting. Interestingly there is no disagreement between the actors in the use of AI systems in the military context. All agree that "*This Regulation shall not apply to AI systems developed or used exclusively for military purposes."* (European Commission, 2021b, p.40).

4.5 Interim conclusion

To answer the research question, the criteria of infrastructure were used to examine the EUs understanding of AI systems. The five main criteria Culture and Diversity, Social Needs, Economic Competition, Sustainability, Safety, and their sub-criteria were used to interpret the EUs publication. The EU shows awareness of many of the issues arising from AI systems that have to be solved, ideally, by keeping in mind the criteria. For the criterion of Culture and Diversity, a willingness to let a diverse group of actors participate is visible. Further, an awareness of the biases within AI systems exists. The EU's approach to the criterion of Social Needs and Access of individuals is based on an appealing character. Member states and companies should increase their efforts to reduce the impact on individuals by educating and retraining individuals. Strong regulation protecting individuals from job loss or forcing companies to retrain is missing. Economic prosperity is created, in the EUs understanding, by evening the playing field and forcing fair competition. In this criterion, the EU does not hesitate to strictly regulate and force companies to comply. Further, massive investments are made to support and enable the green transition in the EU. The criterion of Sustainability is not limited to the sustainable operation of AI systems themselves, but also includes the ability of AI systems to enable sustainable solutions for other sectors. For the criterion of Safety, the EUs understanding is heterogeneous. The EP pushes for stricter regulation, prohibiting all infringements of individual rights while the Council supports less strict regulation. In the final chapter of this thesis, the results will be discussed and an answer to the research question will be given.

5 Conclusion

5.1 Answer to the research question

This thesis sought to answer the research question "In what way does the EU understand and regulate AI systems?" Through a qualitative content analysis of various EU publications and documents, the EUs understanding of the features and criteria of AI systems was examined. The research question is broken down into two sub-questions. The first sub-question, "To what extent does the EUs understanding of AI systems fulfill features of Infrastructure?" was answered by using a critical approach to understanding AI systems functions.

The findings can be summarized as follows. The EU demonstrates a clear comprehension of the feature of Modularity in AI systems. It recognizes the importance of standardization and breaking down AI systems into compatible components to promote a functional digital single market. The EU is aware of the potential for AI systems to be used both for beneficial but also harmful purposes, it aims to regulate high-risk AI systems to prevent harmful abuse. The EUs understanding of the Stability feature is debatable, as the EU focuses on harm reduction and prevention rather than addressing fundamental power imbalances inherent in AI systems. Furthermore, the EU recognizes the Common Need feature in AI systems, understanding their essential role in enabling society to function properly in providing public goods and services. The EU acknowledges the Interdependent feature of AI systems with other infrastructural elements, highlighting the need for a comprehensive approach to enable successful AI systems. In conclusion, all four features of Infrastructure can be found in the EU publications. The extent to which the EU understands AI systems as infrastructure can therefore be answered positively. Even though the EU does not name AI systems as infrastructure, much of its publications and views on the role and effects of AI systems in society can be interpreted

as an infrastructural theoretical understanding rather than a solely technological one. This connects to the theoretical debate of Jaume-Palasi which argued from a similar perspective.

The second sub-question asked, "What infrastructure criteria does the EU fulfill in its understanding?". In this case, a normative theoretical approach to the criteria of infrastructure was used to analyze and examine the EUs understanding of AI systems. The findings contextualize the EUs understanding with the infrastructure criteria. For the criterion of culture and diversity, the EU places great importance on the participation of diverse actors, including societal actors and citizens, in the creation of new regulations for AI systems. The EU also demonstrates awareness of the potential for discrimination in AI systems and emphasizes the risks of algorithmic biases. For the criterion of Social Access and Needs, The EU recognizes the importance of retraining and upskilling the workforce to reduce negative impacts and meet the demands needed to build human-centered AI systems, is considered crucial. Additionally, the EU aims to address inclusion by empowering citizens and respecting fundamental rights. In the publications, there were also findings on reducing the gap between member states. The criterion of Economic Competition is used to create fair conditions and promote green economic growth while addressing market imbalances inside and outside the EU. Furthermore, the EU seeks to use trustworthy AI systems to gain a competitive advantage in the global market. Sustainability is another important criterion in the EU's understanding of AI systems. The EU understands the direct environmental impact of AI systems. Efforts are made to promote sustainable AI applications that increase efficiency and optimize resource consumption across all sectors. For the criterion of Safety, the EU is aware of potential risks in the usage of AI systems by law enforcement and emphasizes the importance of protecting fundamental rights and freedoms. Though no unitary position on the use of real-time identification systems can be found in the EU publications. These findings answer the sub-question. All criteria used by the EU to assess infrastructure were found in the publications. The initial research question can be answered by connecting the findings of both sub-questions. Interpreting the EUs understanding of AI systems it can be argued that it recognizes the infrastructural dimension these developments have. Instead of regulating AI systems like every other technological innovation, the EU is aware of the unique impact AI systems have. Therefore an infrastructural understanding of the EU can be implied. The regulative tools used by the EU are following, in many cases, the suggestions for infrastructure ideal regulation.

That is further evidence that the EU understands AI systems as infrastructure and envisages to regulate it accordingly. Therefore, even though the EU does not explicitly understand or regulate AI systems similarly to infrastructure, the statement can be made that it follows this school of thought.

5.2 Limitations

This insight should be discussed critically in the context of its limitations. One important finding is that the EU often encourages voluntary cooperation of companies instead of strict regulation. With the exception of high-risk AI systems, where rules are precise and forceful, the EU bases its regulative attempts on the good will of companies. One example is that there is no mandatory social clause to reduce the impact on workers. An explanation for this is the tradition of the EU to be a rather market oriented institution instead of a social one. This is problematic because the publications show that a social adjustment is expected and aspired by the EU itself. Another shortcoming in the findings is the investment category. This thesis did not have the focus nor the resources to examine the concrete investment strategy of the EU. The amounts spent are exorbitant and deserve their own research. Nevertheless, a few questions arise. It seems as if the investments are not connected to any conditions and are given in a "springer can" approach. As found in the stability feature of infrastructure, power is centralized in the hands of a few actors. The possibility of abuse by the few in power exists. One aspect is also found in the analysis. The different actors involved in the legislative procedure of the EU weigh the risk of power centralization differently and therefore also propose different measures. This diverging understanding of the EP, Council and Commission became evident and is also a limitation of this research. Through the nature of the EP, it is in a constant power struggle with the other institutions. The Commission and the EP aim to increase their jurisdiction and power and therefore naturally suggest regulations to be on the EU level instead of the national state. Some findings, like the vehement push of the EP for more participation of diverse groups, are also explained by this, in the treaties' inherent, nature. The EP is the only direct elected actor and in a constant fight for more participation. Other limitations are the data sets. While documents from a diverse actor group were analyzed this list is limited. The Council and its opinions are underrepresented, while the EP

is overrepresented. Further, many of the documents are legal documents that always have their own tone and understanding. This was engaged in the most possible way by using qualitative content analysis.

5.3 Future prospect

Further research should focus on the conflicting positions of the EP, Council and Commission and how a consensus can be found. Additionally, the role of non-legislative actors, like NGOs, lobby groups and experts in the policy-making process is also a future topic of interest. The theoretical foundation of this research, a critical perspective via an infrastructural understanding of AI systems, should also be further discussed and developed. The research contributes to the debate about AI regulation and created special insights on the current debate of the proposed AI Act. It can help policymakers and experts to gain a critical perspective on the proposed regulation and contribute to closing the gap between values and practical law. For lawmakers outside the EU, this thesis can provide initial guidelines around what type of regulations should be chosen for AI systems considering their special implications for society. Considering that impacts of AI systems are impacting societies faster and stronger it is important to have a well informed civil society. This research can contribute to an educated civil society that can critically discuss and contribute to the debate on AI systems. In the coming time the EUs proposed AI Act will be measured against reality. Its interpretation and improvements will determine how the European citizens will be affected and protected.

6 References

ATLAS.ti Scientific Software Development GmbH. (2023). *ATLAS.ti User Manual*. https://doc.atlasti.com/ManualMac/ATLAS.ti_ManualMac.23.pdf?_gl=1*1vha6qy*_ga*MTYwMTg3ODE5MS4xNjgwMjU4MzY4*_ga_K459D5HY8F*MTY4MDY1ODEzMi4yLjAuMTY4MDY1ODEzNC4wLjAuMA..&_ga=2.138101040.1067159284.1680658132-1601878191.1680258368

BMDV. (2021, July 27). *BMDV - Gesetz zum autonomen Fahren tritt in Kraft*. https://bmdv.bund.de/SharedDocs/DE/Artikel/DG/gesetz-zum-autonomen-fahren.html

Bradford, A. (2021). *The European Union in a globalised world: The "Brussels effect" - Groupe d'études géopolitiques*. Https://Geopolitique.Eu/. https://geopolitique.eu/en/articles/the-european-union-in-a-globalised-world-the-brussels-effect/

Cath, C., Wachter, S., Mittelstadt, B., Taddeo, M., & Floridi, L. (2018). *Aritifical Intelligence and the "Good Society": The US, EU and UK approach*. https://doi.org/10.1007/s11948-017-9901-7

Committee on Culture and Education. (2022). *OPINION of the Committee on Culture and Education on the proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts*. European Parliament.

Committee on Industry, Research and Energy. (2022). *OPINION of the Committee on Industry, Research and Energy on the proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts*. European Parliament.

Committee on Legal Affairs. (2022). *OPINION of the Committee on Legal Affairs Committee on Legal Affairs on the proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts*. European Parliament.

Committee on the Internal Market and Consumer Protection Committee on Civil Liberties, Justice and Home Affairs. (2022). *DRAFT REPORT on the proposal for a regulation of the European Parliament and of the Council on harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts*. European Parliament. https://www.europarl.europa.eu/doceo/document/CJ40-PR-731563_EN.pdf

Committee on Transport and Tourism. (2022). *OPINION of the Committee on Transport and Tourism on the proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (artificial intelligence act) and amending certain union legislative acts*. European Parliament.

Council of the European Union. (2022). *Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts—General approach*. https://data.consilium.europa.eu/doc/document/ST-14954-2022-INIT/en/pdf

Dafoe, A. (2017). *AI Governance: A Research Agenda*. University of Oxford.

Douglas, Y., Inez, K., Nihdi, K., & Osonde, O. (2021). Identifying Systemic Bias in the Acquisition of Machine Learning Decision Aids for Law Enforcement Applications. *RAND Corporation*. http://www.jstor.org/stable/resrep29576.

Duan, Y., Edwards, J. S., & Dwivedi, Y. K. (2019). Artificial intelligence for decision making in the era of Big Data – evolution, challenges and research agenda. *International Journal of Information Management*, *48*, 63–71. https://doi.org/10.1016/j.ijinfomgt.2019.01.021

Ellery, S. (2023, March 28). Fake photos of Pope Francis in a puffer jacket go viral, highlighting the power and peril of AI. *CBS News*. https://www.cbsnews.com/news/pope-francis-puffer-jacket-fake-photos-deepfake-power-peril-of-ai/

European Commission. (2018). *Coordinated Plan on Artificial Intelligence*.

European Commission. (2019). *Building Trust in Human-Centric Artificial Intelligence*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0168

European Commission. (2020). *A European strategy for data*.

European Commission. (2021a). *Fostering a European approach to Artificial Intelligence*.

European Commission. (2021b). *Proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on Artifical Intelligence (Artificial Intelligence Act) and amending certain Union legislative acts.*

European Commission, D.-G. for R. and U. P. (2000). *ESDP - European Spatial Development Perspective: Towards balanced and sustainable development of the territory of the European Union*. Publication Office.

European Parliament. (n.d.). *Ordinary legislative procedure*. European Parliament. Retrieved June 21, 2023, from https://www-europarl-europa-eu.ezproxy2.utwente.nl/infographic/legislative-procedure/index_en.html

Given, L. M. (2008). *The Sage encyclopedia of qualitative research methods* (1–1 online resource). SAGE. https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=525887

Greenwood, J. (2017). *Interest representation in the European Union* (4th ed). Palgrave Macmillan.

High-Level Expert Group on Artificial Intelligence. (2019). *Ethics Guidelines for Trustworthy AI*. https://ec.europa.eu/futurium/en/ai-alliance-consultation.1.html

Horkheimer, M., & Adorno, T. W. (1969). *Dialektik der Aufklärung: Philosophische Fragmente*. Fischer Taschenbuch Verlag.

Ioannidis, M. (2017). Weak Members and the Enforcement of EU Law. In A. Jakab & D. Kochenov (Eds.), *The Enforcement of EU Law and Values: Ensuring Member States' Compliance* (p. 0). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198746560.003.0028

Jaume-Palasi, L. (2019). Why We Are Failing to Understand the Societal Impact of Artificial Intelligence. *Social Research: An International Quarterly*, *86*(2), 477–498.

Jochimsen, R. (1966). *Theorie der Infrastruktur: Grundlagen der marktwirtschaftlichen Entwicklung*. Mohr.

Kessler, G. (2021, November 11). Analysis | Robert Moses and the saga of the racist parkway bridges. *Washington Post*. https://www.washingtonpost.com/politics/2021/11/10/robert-moses-saga-racist-parkway-bridges/

Larroche, V. (2019). *The dispositif: A concept for information and communication science*. ISTE Editions.

Loo, R. van. (2018). *Technology Regulation by Default: Platforms, Privacy and the CFPB*. *531*.

Marchant, G., Sylvester, D., & Abbot, K. (2009). *What Does the History of Technology Regulation Teach Us about Nano Oversight*. *37*(4), 723–731.

Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*.

Milmo, D., & O'Carroll, L. (2023, May 22). Facebook owner Meta fined €1.2bn for mishandling user information. *The Guardian*. https://www.theguardian.com/technology/2023/may/22/facebook-fined-mishandling-user-information-ireland-eu-meta

Möllers, T. M. J. (2019). *Juristische Methodenlehre* (2. Auflage). C.H. Beck.

Noordt, C. van, Medaglia, R., & Misuraca, G. (2020). Stimulating the Uptake of AI in Public Administrations: Overview and Comparison of AI Strategies of European Member States. *Proceedings of Ongoing Research, Practitioners, Workshops, Posters, and Projects of the International Conference EGOV-CeDEM-EPart 2020*, 269–277. https://research.cbs.dk/en/publications/stimulating-the-uptake-of-ai-in-public-administrations-overview-a

Palmquist, M. (2016, August 3). *Introduction to Content Analysis*. Columbia University Mailman School of Public Health. https://www.publichealth.columbia.edu/research/population-health-methods/content-analysis

Peters, J. (2012). Neoliberal convergence in North America and Western Europe: Fiscal austerity, privatization, and public sector reform. *Review of International Political Economy*, *19*(2), 208–235. https://doi.org/10.1080/09692290.2011.552783

Riccucci, N. M. (2010). Envisioning Public Administration as a Scholarly Field in 2020: Rethinking Epistemic Traditions. *Public Administration Review*, *70*(s1), s304–s306. https://doi.org/10.1111/j.1540-6210.2010.02294.x

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed). SAGE.

Schwan, B. (2023, June 23). KI im Sozialwesen: Wer Hilfe braucht, entscheidet die Software – und zwar falsch. *Die Zeit*. https://www.zeit.de/digital/internet/2023-06/ki-sozialwesen-sozialhilfe-weltbank-jordanien?utm_referrer=https%3A%2F%2Fwww.google.com%2F

Simpson, E., & Conner, A. (2021). *How To Regulate Tech: A Technology Policy Framework for Online Services* (p. 73). https://www.americanprogress.org/article/how-to-regulate-tech-a-technology-policy-framework-for-online-services/

Smil, V. (2005). *Creating the Twentieth Century: Technical Innovations of 1867-1914 and Their Lasting Impact*. Oxford University Press.

7 List of Figures

8 Appendix

8.1 Appendix 1

Name	Institution	Year
Coordinated Plan on Artificial Intelligence + Annex	Commission	7.12.2018
Building Trust in Human-Centric Artificial Intelligence	Commission	8.4.2019
Ethics Guidelines for Trustworthy AI	High-Level Expert Group on Artificial Intelligence	8.4.2019
A European strategy for data	Commission	19.2.2020
Fostering a European approach to Artificial Intelligence	Commission	21.4.2021
Regulation of the European Parliament and of the Council	Commission	21.4.2021
Draft Report	European Parliament	20.4.2022
OPINION of the Committee on Culture and Education	European Parliament	16.6.2022
OPINION of the Committee on Transport and Tourism	European Parliament	12.7.2022
OPINION of the Committee on Legal Affairs	European Parliament	12.9.2022
OPINION of the Committee on Industry, Research and Energy	European Parliament	14.6.2022
OPINION of the Committee on the Environment, Public Health and Food Safety	European Parliament	22.4.2022
General Approach	Council of the EU	25.11.2022

8.2 Appendix 2.1

Concept / Dimension	Example	Coding
Modularity	“Building on Europe’s strengths, to develop and implement in partnership with industry and Member States shared agendas for industry-academia collaborative Research and Development (R&D) and innovation.“ (European Commission, 2018, p.13)	Modularity of AI systems through seeing AI systems as something that is build upon and that can be splitt in different steps. Question also: How can abuse be stoped or prevented?
Stability	„Artificial Intelligence Board’ (the ‘Board’) shall be established.“ (Committee on the Internal Market and Consumer Protection Committee on Civil Liberties, Justice and Home Affairs, 2022, p.96)	In what way are AI systems descripted as creaters or controllers of power. Who controls AI and decides how the systems share power? Who has the power?
Common Need	“To do this, AI systems8 need to be human-centric, resting on a commitment to their use in the service of humanity and the common good, with the goal of improving human welfare and freedom.“ (High-Level Expert Group on Artificial Intelligence, 2019, p.6)	Uniqueness of AI (high costs of R&D), Common usage, Looking for examples where AI systems are seen as something that benefits society and also cannot be producted for everyone / not suffieciently Public Funding
Interdepedency	“Further developments in AI require a well-functioning data ecosystem built on trust,	Naming of other parts involved, logistics (hard

	data availability and infrastructure." (European Commission, 2018, p.7)	infrastructure/fundings/computing power)

8.3 Appendix 2.2

Concept	Subcategory	Keywords
Social Needs and Access	Education	Universities, Schools, Students, Research, Development,
	Training	Retraining, Upskilling, Reskilling
	Job loss	Job lose, unemployment, firing, lay offs
	EU Memberstate Gap	Member state gap, regional gap, regional development
	Inclusion	Inclusion, Exclusion, Equality, Diversity
Economic Competition	Fair Competition	Fair competition, equal conditions, fair market, fair access
	Economic Growth	Growth, Innovation, Prosperity, economic benefits
	Investment	Investment, Subsidies
Culture and Diversity	Participation of People	Participation, representation,
	Awareness: Discrimination	Discrimination, Gender Gap, Data Gap, Bias, Sexism
	Awareness: Effect on Culture	Culture, Society, Media,
Safety	Awareness: Abuse by Authorities	Fundamental rights, abuse, individual rights
	Military Development	Military
	Police/Intelligence Development	Surveillance, Abuse, Biometric, cameras
Sustainability	/	Green transformation, transition, climate change, emissions

9 List of abbreviations

Data Act	European Data Governance Act
EP	European Parliament
EU	European Union
GDPR	General Data Protection Regulation
SMEs	Small and Medium Enterprises
TFEU	Treaty on the Functioning of the European Union