Combating COVID-19 Infodemic on Social Media: A Comparative Institutional Analysis

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Preface

The thesis marks an end of an incredible journey and the beginnings of a new chapter in my life. COVID-19 has affected and changed our lives in many ways. In the beginning, when all of us were stuck in our homes, there was a lot of uncertainty about what will happen next and no one knew for sure about the novel coronavirus. Being confined to the four walls, my laptop and mobile phone became my companion to pass time like many others. Social media platforms became even more prominent in our lives as evident by many lockdown trends as the entire world was trying to do something, keep themselves busy and have a distraction from the world of uncertainty around them. During this time, one could look at many contradicting information regarding the pandemic. Over time, we found social media platforms removing content and labelling misinformation. As someone who was pursuing a specialization in cybersecurity management and economics and finance, I was naturally interested in this. I wanted to attempt to understand the problem and try to find effective solutions to combat the COVID-19 infodemic on social media platforms. This motivation has led to this thesis.

This thesis would not have been possible without the help, support and guidance of my thesis committee members. Dr. Ir. R. (Rutger) van Bergem is the first person whom I contacted on the committee. From the beginning, he has challenged me on how I view certain things, made me think from different perspectives and pushed me to explore new theories. Dr. A.F. (Aad) Correljé, my chair, never shied away from asking me tough questions but at the same time was very supportive of my work. Dr. N. (Nadia) Metoui comes from a technical background and offers me a different perspective on my thesis for which I am grateful. The entire committee has been encouraging and supportive of my work but at the same time pushing me to do well such that I can also be proud of the end product.

I would also like to use this opportunity to thank my parents without whose belief in me and support, my journey to the Netherlands would not have been possible. Being the first graduate from my family and being the first person in my immediate family to pursue Masters abroad, my parents have invested in me and supported my aspirations. I would also like to take this opportunity to thank all my friends both new one's I made over here and back home in India to be a constant support, encouraging me and motivating me to do the best that I can. I hope you would enjoy reading this thesis, the perspective it offers and try to answer the new questions that it poses.

Arjunraj Govindaraj Ayyanar
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Summary

Social media has changed the way we receive and consume information. People are increasingly turning towards social media to receive the latest information. Lately, there has been increased scrutiny about "fake news" on social media platforms. False information as a result of both misinformation and disinformation is of real concern especially when they deal with public health information. They can cause irreparable harm to lives and society at large. COVID-19 infodemic has highlighted that the existing measures to combat false information on social media platforms are not effective. COVID-19 situation is unique such that the disease is new and knowledge about it is evolving all the time. There is a lot of uncertainty on existing information and it gets revised as new information comes to light. This shows the existence of an information gap and this can contribute to false information. Thus, there is an urgent need to comparatively analyse the public health institutions and the social media information system to understand their information discovery process, how they differ from each other, how they could contribute to false information online and what measures can effectively disincentivise the spread of false information on the social media platform .

This thesis analyses the social media information system from a comparative institutional perspective. It utilises an exploratory qualitative research approach, combining a literature review with case studies. At first, an analysis is conducted to determine the impact of false information related to COVID-19 on Facebook. This is followed by a case study analysis consisting of three cases to examine the institutional factors that affect the information discovery process in public health institutions related to COVID-19 using the public choice theory. Next, an examination of the institutional environment under which information is regulated on social media platforms using the alignment perspective from new institutional economics is analysed. Lastly, an analysis is performed to identify how the information discovery process on social media platforms can be positively leveraged to combat false information from an institutional context using a mix of knowledge as discovery procedure and public choice theory. This is accompanied by a comparative case study analysis. By combining the results of these analyses, the thesis attempts to answer how the differences in the information discovery process between public health institutions and social media platforms contribute to false information on social media platforms from a comparative institutional perspective. This is followed by recommendations on possible measures to effectively combat false information on social media platforms by taking the differences in the information discovery process into consideration.

From the analysis, it is evident that COVID-19 false information on social media platforms has serious negative consequences. It is difficult to ascertain this quantitatively due to lack of data but the impact of false information has shown that it can affect the way people comply with the measures suggested by public health institutions. This reinforces the urgent need to combat the infodemic. From the case study analysis of three different cases, it is evident that there are common institutional factors such as budget behaviour, expert failure and political self-interests that affects the information discovery process across the three cases. As a result, the information recommended by public health institutions is not fully based on medical reasoning. Thus, there are flaws in their recommendations. This flawed information is used to regulate information on social media platforms. Analysis of the institutional environment that regulates information on social media platforms shows that public health institutions lack the authority to enforce regulations. They are dependent on the government and social media platforms. Technology is leveraged to enforce the regulations but the effectiveness of technology is questioned due to the failure of existing measures and the lack of data regarding its performance. Analysing the information discovery process in social media platforms shows that factors such as the low cost of publishing opinions to a wider audience, reputation, the need to be the first, followers and brand building drive social media users to post information on social media platforms. A wide variety of opinions are posted on social media platforms of which some are true. This is highlighted using a comparative case study analysis. At the same time, information from public health institutions is driven by other factors which could result in flawed recommendations. Due to the uncertainty of the pandemic, the need for quick information and the information gap, the differences in the information discovery process between public health institutions and social media platforms can lead to the spread of false information on social

media platforms.

Based on the results of the analysis, a comparison between the information discovery process between public health institutions and social media platforms is presented in table 8.1. It highlights a need for a mechanism in social media platforms for filtering information such that the probability of arriving to the right information is increased. Thus, a recommendation is made to leverage prediction markets to act as this mechanism. In prediction markets, people can bet on ideas. This forces people to act rationally as they would make calculated decisions not to lose money. There is also an additional risk of maintaining reputation as people would always like to be on the winning side of such bets. This could make people re-evaluate their opinions related to COVID-19 as new information comes to light due to a lot of uncertainty existing around COVID-19. The prediction market could help to filter out irrational opinions as people would likely not bet in favour of them. In this way, the probability distribution for the right information can be incentivised on social media platforms. Further research could envision how this prediction markets can be integrated with the existing social media platforms.

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1 Introduction

1.1. Background

In recent times, there has been increased scrutiny of “fake news” in social media. This phrase “fake news” has also been politicised and used against the news industry to undermine their credibility (UNESCO, 2018). Thus, instead of loosely using the term “fake news”, it is essential to classify false and/or harmful content as disinformation, misinformation and malinformation (UNESCO, 2020). Disinformation refers to false information that is deliberately created to hurt a person, social group, organisation or country (UNESCO, 2020). Misinformation refers to false news created without the intention of causing harm (UNESCO, 2020). Malinformation refers to information based on the reality that is used to harm a person, social group, organisation or country (UNESCO, 2020). False information as a result of both misinformation and disinformation is of real concern especially when they deal with public health information. They can cause irreparable harm to lives and society at large. Unfortunately, social media is prime to disseminate false information.

Social Media has changed the way we receive and consume information. Before the advent of social media, journalism through newspaper and television news were the major source of information for people. This has changed since the rise in the popularity of social media. A survey has found that over 50% of internet users surveyed have heard about the latest news on social media first (Martin, 2018). This growing trend shows how people are relying on social media platforms to provide them with the latest news. In a research study by Stocking et al. (2020), the authors found that only about 1% of public posts on Facebook related to COVID-19 had links to health and science sites. Due to information overload existing in social media, the platform algorithm picks popular social media posts to increase its engagement with the user (Menczer and Hills, 2020). This increases the possibility of people being exposed to inaccurate public health information and makes them more susceptible to false information.

People with access to social media have access to an abundance of information. A large amount of false information is associated with the COVID-19 pandemic and as a result has been termed an Infodemic (Cinelli et al., 2020). The World Health Organization (WHO) defines infodemic as an overabundance of information, both online and offline which includes deliberate attempts to disseminate wrong information to undermine the public health response and advance alternative agendas of groups or individuals (World Health Organization, 2020a). COVID-19 is the first pandemic in which technology and social media are being used to keep people safe, informed, productive and connected. The same technology and social media are enabling and amplifying an infodemic that continues to undermine the global response and jeopardizes measures to control the pandemic. The infodemic has resulted in serious negative consequences with widespread impact on our society. It has sown distrust of public institutions and as a result, people are divided and polarised. This has caught the attention of the government, research scholars, social media platforms and other actors. Thus, steps are being taken to address the infodemic with a sense of urgency. The purpose of this research is to identify how the response to the infodemic can be better optimised. For this purpose, COVID-19 infodemic and response to it is taken as a case study.

1.2. Problem

In the previous section, the perils of infodemic have been noted. For the first time, our society is dealing with public health infodemic at such a rapid pace where there is a very high volume of information and different kinds of false information. Even then, this is not the first time our society is dealing with false public health information online. There have been numerous policy responses by various actors since 2016 to combat false information online especially through social media. The recent past shows that it has not been as effective as expected. A common thread across most of the measures is that they are punitive measures, which often do little to change the mindset and as such must be repeatedly reinforced and maintained at the cost of monitoring and enforcement (Hartley and Vu, 2020). The problem is exacerbated by the growing lack of public trust in government institutions which helps in further spreading of disinformation (Bennett and Livingston, 2018). The punitive measures are feeding this distrust and making it difficult to combat false information. The proposed solutions though look perfect on paper has not been successful in combating false information. These measures are a reaction to a symptom of a larger problem.

COVID-19 situation is unique such that the disease is new and information about it is evolving all the time. There is a lot of uncertainty on existing information and it gets revised as new information comes to light. In such a situation, there is uncertainty on what is true information. For example, the COVID-19 lab leak theory which spread on social media was initially dismissed by authorities but it is being seriously probed right now. This shows that due to uncertainty, there is an information gap. This information gap is being addressed by two different institutions - public health institutions and social media platforms. Both these institutions operate under different rules, the way they gather information and distribute them. Due to a very high public interest, there is a speed premium associated with addressing this information gap. This demands an exploratory study to ascertain key aspects of the problem to better optimise the response to false information on social media platforms. It is essential to analyse various actors and their role from an institutional perspective to better understand the existing rules, incentives and governance structure in the social media information system and how it influences the information discovery process. In the context of this thesis, a social media information system refers to the government, public health institutions, social media platforms and social media users who are involved in creation, distribution, manipulation and regulation of information related to COVID-19 on social media platforms. A new institutional economics perspective (NIE) can help in analysing the social media information system critically as it does not bound itself to hypothetical ideals such as benevolence, zero transaction costs, full credibility of the involved actors but instead deals with feasible organizational alternatives (Williamson, 2000). The insights generated could lead to better policies that are practical and can effectively combat the Covid-19 infodemic.

1.3. Research Objective

COVID-19 infodemic has had serious implications on society's response towards the pandemic and how to overcome the challenges ahead. Since the false information associated with the infodemic is varied and has different effects based on context and the target of false information, a case study on selected kinds of false information is performed. False information based on COVID-19 severity, masks and false cures are the three cases that are chosen. These case studies were chosen based on the research by Shapiro et al. (2020) who did a qualitative study on 5,613 distinct misinformation stories from the early days of the pandemic through the end of December 2020. The selected cases are some of the common false information themes found in this study. These case studies can help to understand the different circumstances and the failures associated with the way the situation was dealt with to identify underlying patterns or commonalities associated with different kinds of false information. Such patterns if identified can provide insights to frame effective policies. Facebook is chosen as the social media platform as a proxy for false information online. This is based on the facts that Facebook has about 1.84 billion daily active users and it is a leading social media platform reaching 59% of social media users (Mohsin, 2021). This implies that combating false information on Facebook alone will have a huge impact on false information in social media and the learnings can then be transferred to other platforms where applicable to have a healthy social media information system.

The term COVID-19 infodemic outlines the negative consequences of false information during the management of disease outbreaks. This is an interesting case to analyse as it covers false information from both political and public health sectors. These sectors are commonly hit with false information and utilise similar strategies to combat them. There are already measures in place to combat false information but have been

proven to be ineffective. Another interesting aspect of the case is that there is a speed premium attached with information as there is a competition between two sources of information - one from public health institutions and another from social media platforms. Since there is uncertainty about which information is true, speed becomes an important factor in the information discovery process. An institutional analysis of this case could lead to effective solutions to combat false information online. An institutional analysis can help to identify the gaps in the existing rules in the social media information system which has resulted in this problem.

Therefore, the research takes an exploratory approach and the main research objective of this thesis is to perform a comparative institutional analysis between public health institutions and social media platforms with respect to their information discovery process and how differences between them can lead to false information on social media platforms. In the context of this thesis, the information discovery process refers to the processes that affect the available information related to uncertainties associated with COVID-19. For example, whether masks are useful or not in preventing COVID-19 transmission was uncertain in the beginning as no one knew for sure due to the novel nature of the virus. The information discovery process for public health institutions here refers to the processes that influence the decision of these institutions on the usage of masks to prevent COVID-19 transmission. The information discovery process for social media platforms refers to the processes that influence social media users to post information related to masks on social media platforms. This objective allows systematic review of the social media information system, how information discovery process works, existing policies present to combat false information and how can the system be reformed to combat false information effectively.

Comparative institutional analysis is a field of study which aims at elaborating new scientific knowledge in the complex topic of the structural differences of economic systems and their performance (Solari, 2002). This allows exploring how different institutional arrangements leads to different outcomes. This is perfect for the thesis as it explores two different institutional information discovery processes and how their outcomes differ. Comparative institutional analysis is often treated as a singular approach to diagnosing and potentially resolving social dilemmas (Cole, 2012). It demonstrates that a variety of institutional arrangements are possible and that the differences between them may be important to resolve such problems (AOKI, 1996). This methodology is ideal for the thesis as it tries to address a complex topic, with nuances that seek to address different institutional arrangements, how it affects the information discovery process and what are its implications. The comparative institutional analysis approach helps to explain the key differences between the two information discovery process, how it affects the outcomes and how they can be leveraged to combat COVID-19 false information on social media platforms. To do so, the following sub-objectives have to be met. They are:

- To determine the impact of false information related to COVID-19 on Facebook.
- To identify factors that influences the information discovery processes in public institutions related to COVID-19.
- To examine how information generated by public health institutions are enforced.
- To examine information discovery process on social media platforms.

1.4. The Relevance of Study

This research has both societal and academic relevance. The academic relevance can be found in the lack of established methods to handle this infodemic. This is the first time where an infodemic as a result of pandemic and false information has occurred. The path forward is still unclear and there are a lot of questions. This is evident by calls from WHO for research to improve the understanding of and response to infodemics during public health emergencies (World Health Organization, 2021a). The social media information system is not a stand-alone system. The information that exists on social media platforms is determined by rules embedded in the social and legislative or institutional context. The thesis undertakes a comparative institutional analysis between two different institutions - public health institutions and social media platforms on their information discovery process and how differences between them can lead to false information on social media platforms. Thus, an exploratory study from an institutional perspective could provide some needed insights. NIE helps to explain what institutions are, how they arise, what purposes they serve, how they change, and

how they can be reformed (Klein, 1998). The institutional perspective analyses the present social media information system to identify the existing rules that govern the present infrastructure, incentives of the actors involved and point to the gaps in the system. Addressing these gaps can help in better governance initiatives and policies to combat false information on social media. These gaps can be addressed by critically analysing the role of different actors to come up with feasible solutions instead of hypothetical ideals to frame better public policy.

Societal relevance stems from the urgent need to combat the infodemic to bring the pandemic under control and the need to rebuild the trust of the people in public health institutions. This is a tough and challenging process. The study could show direction and provide insights on how this could materialise. For example, how information discovery process in public health institutions can be improved to combat false information on social media platforms.

1.5. Research Question

The main research question is needed to realize the main objective of this thesis. Besides the main research question, a set of sub-questions is required to manage the research. The answers to these sub-questions will contain part of the information that is necessary to answer the main research question and meet with the research objective. The main research question and the deduced sub-questions are presented.

The goal of this thesis is to undertake a comparative institutional analysis between public health institutions and social media platforms with respect to their information discovery process and how differences between them can lead to false information on social media platforms. The expected outcomes are a comparison showing the difference between the information discovery process between public health institutions and social media platforms, how they contribute to false information and a recommendation that can leverage the differences to combat false information on social media platforms effectively. The main research question is **"How does the difference in the information discovery process between public health institutions and social media platforms contribute to false information on social media platforms from a comparative institutional perspective?"**. The proposed study presents a theoretical and qualitative analysis to the understanding of the institutional differences between the information discovery process between public health institutions and social media platforms and their role in false information on social media platforms. The main research question is evaluative in nature, as it proposes research that evaluates the differences between two information discovery processes and their role in false information on social media platforms. The sub-questions are related to the sub-objectives given above. To get all the input which is necessary to answer the main research question some sub-questions are defined as follows:

1. What is the impact of COVID-19 false information on Facebook?
2. What institutional factors affect the information discovery process in public health institutions related to COVID-19?
3. What is the institutional environment under which information related to COVID-19 is regulated on social media platforms?
4. How can the information discovery process on social media platforms be positively leveraged to combat false information from an institutional context?

The first sub-question helps to present an overview of the problem of false information on social media platforms, identify how much false information is circulating in social media concerning COVID-19 and its impact. This will provide clarity on the magnitude of the problem and reflect on the present situation. The following sub-question explores the incentives of public health institutions in their decision-making, how it affects the information discovery process and how it can contribute to propagating false information. The third sub-question gives insights into the institutional framework under which COVID-19 information is regulated on social media platforms. This will also provide the building blocks of institutional perspective on the rules governing the social media information system and the governance structure in place to combat false information. The last sub-question explores the information discovery process on social media platforms, incentives for posting information and how spreading false information on social media platforms can be disincentivised. Combining the answers of all four sub-questions, the main research question can be answered.

1.6. Thesis Outline

The thesis layout begins with a background in chapter 1 which comprises of a background, problem, research objective, relevance of the study and research question. This is followed by a literature review in chapter 2. Chapter 3 explains the research methodology of the thesis. Chapters 4,5, 6 and 7 attempts to answer the four research sub-questions. These answers are combined to answer the main research question and is then followed by discussion and recommendations in chapter 8.

2

Literature Review

2.1. False information concerning COVID-19

Ever since COVID-19 was declared as a pandemic in March 2020, Facebook posts related to COVID-19 occurred across public spaces with a wide spectrum of subject orientations in the social media platform (Stocking et al., 2020). The study also identified about 6.5 million total English-language posts that mentioned COVID-19 in more than 350,000 public Facebook pages and groups between March 1 and March 31, 2020. It was also noted that only a small fraction of 1% of COVID-19 Facebook posts had links to healthcare and science sites, including public health sites while news media sites accounted for 74% (Stocking et al., 2020). The combinations of the unknown virus, people's interest and political factors made COVID-19 a prime target for false information.

Shapiro et al. (2020) in the "ESOC COVID-19 Disinformation Tracking Report" were able to track the very early trends of false information concerning COVID-19. The themes of the false information revolved around fake cures and preventative measures, nature of the virus, the origin of the virus, COVID-19 status of individuals and groups, governmental response, non-governmental response, false diagnostic procedures and weaponization or design of the virus. Due to the widespread nature of COVID-19 false information, there was increased scrutiny of social media platforms. As a result, social media platforms started sharing data regarding the steps they take to combat COVID-19 false information with the European Commission in the interest of transparency (European Commission, 2021a). These reports indicate that hundreds of thousands of posts have been removed by social media platforms in response to removing false information from their platforms. Facebook and Instagram alone have removed over seven million posts related to COVID-19 false information between April and June 2020 (Lerman, 2020). In the same period, the company has also put warning notes on 98 million covid-19 misinformation posts on Facebook that period such that they labelled the posts that were misleading but were not deemed to be harmful enough to remove (Lerman, 2020).

The sheer volume of false information makes it challenging to detect false information. Shu et al. (2020) in "Combating false information in a social media age" identifies content-related and user-related challenges in combating false information. The content of false information is usually highly sensationalized and is written using extreme sentiments to affect the readers and make them interact with them. Thus, such posts usually become viral and trend on social media. In addition to that, the low cost of creating false information sources and the ease of using software-controlled social media bots to help spread false information. From the user perspective, social media users are susceptible to false information, and they often lack awareness of false information. This is evident from the research showing that verified social media users fuel COVID-19 fake news (Wiggers, 2020). Wilson and Wiysonge (2020) in " Social media and vaccine hesitancy" noted in their research that a 1-point shift upwards in the 5-point disinformation scale is associated with a 2-percentage point drop in mean vaccination coverage year over year. The research shows a correlation between false information in social media and vaccine hesitancy but there can be other factors along with false information in social media causing this effect. Other contributing factors like messaging from authorities or negative press coverages on side effects of particular vaccines can also contribute to vaccine hesitancy. Since there is a high possibility of negative consequences of COVID-19 false information on social media and vaccine

hesitancy, there is an urgent need to tackle false information concerning COVID-19 vaccines as governments across the world look at ways to ensure that their citizens get vaccinated. Thus, this section highlights how the government and other relevant actors struggle and compete with false information to communicate with the general public to give them the right information.

2.2. Combatting COVID-19 False information

Saurwein and Spencer-Smith (2020) in their research "Combating Disinformation on Social Media: Multilevel Governance and Distributed Accountability in Europe" identify that the proliferation of false information on social media has been a result of a socio-technical mix consisting of algorithms, platform design, human factors and political and commercial incentives. They showed that it is essential to involve multiple stakeholders such as social media companies, social media users, the government and other organizations such as advertisers, fact-checking agencies to work together to combat false information through multilevel governance and accountability initiatives. This represents the scale and the complexity of the problem and challenges associated with combating false information. Due to the building up of political and public pressure surrounding the urgent need of combating false information, representatives from leading social networks, online platforms, advertisers and the advertising industry have agreed on a self-regulatory Code of Practice to address the spread of online false information and fake news (Saurwein and Spencer-Smith, 2020). These efforts were championed by the European Commission. These self-regulatory measures have resulted in a change in policies of social media platforms, responsible advertising, use of independent fact-checkers to verify claims and even removal of harmful content and accounts associated with it (Saurwein and Spencer-Smith, 2020). Even though these steps look promising, they have their challenges. Social media companies cannot change their policies to change algorithms completely as their core business hinges on user engagement. Independent fact-checking lacks funding to keep up with the growing demands of verifying and flagging false information The removal of harmful content and accounts associated with it are done too late such that the false information might have been viewed by millions before being removed.

Borrás and Edler (2020) in "The roles of the state in the governance of socio-technical systems' transformation" describe the possible thirteen roles the government could play in the transformation of socio-technical systems in the cases of cryptocurrencies, smart cities, automated vehicles, nuclear power. On expanding this to false information, it is noticed the government has played a relatively passive role as an observer, warner, enabler of societal engagement, promoter and watchdog. This might change soon as the European Commission has concluded that the self-regulatory mechanism has failed to guarantee transparency and accountability (Saurwein and Spencer-Smith, 2020). Different countries have taken different measures to address disinformation. Some countries such as Germany, Italy and France implemented new laws which comprise fines and/or jail terms (Saurwein and Spencer-Smith, 2020). Some have even expanded the powers of law enforcement to fact-check and file legal action if found that the information is false. The challenge here lies in identifying the perpetrators of false information and many times the offenders might be from different jurisdictions. Even if the offender is found within the jurisdiction, it is a challenge to prove that the accused knowingly promoted disinformation.

On the other hand, there are countries such as Belgium, Finland, Netherlands, Luxembourg and Sweden focussed on promoting media literacy and critical thinking through educational initiatives (Saurwein and Spencer-Smith, 2020). This empowers social media users to combat false information by critically evaluating the authenticity of the source of the information. Guess et al. (2020) in their research "A digital media literacy intervention increases discernment between mainstream and false news in the United States and India" found that relatively short, scalable interventions could be effective in fighting misinformation around the world. The study also finds that media literacy campaigns could be an effective strategy to help counter false or misleading news. Shu et al. (2020) in "Combating disinformation in a social media age" suggest that research and collaboration should be supported and promoted among researchers from different fields to understand the multifaceted implications of false information to mitigate its effect on society.

Public health institutions such as WHO started taking steps to combat false information head-on. They designed and publicized shareable infographics to debunk coronavirus myths. The research by Vraga and Bode (2021) in "Addressing COVID-19 Misinformation on Social Media Preemptively and Responsively" found that even though graphics do not affect all misperceptions, reductions in misperceptions that do occur persist

over time. These effects were consistent whether the graphic was shared by the WHO itself or by another user. The study recommends that social media users should be motivated to share such official graphics from sources of authority to have a greater effect in combat against false information. In "Protecting the Value of Medical Science in the Age of Social Media and Fake News", Merchant and Asch (2018) identified provenance, engagement, transparency, narrative and reputation as possible countermeasures that can be used by the medical science community to tackle false information. Thus, various stakeholders have come together to fight against false information through various means.

2.3. Institutional Perspective Social Media Platforms

Social media platforms are a type of multi-sided platforms (MSPs). Abdelkafi et al. (2019) in "Multi-sided platforms" describe MSP as platforms that connect two or more interdependent user groups, by playing intermediation or a matchmaking role. The authors attribute the success of the MSPs to their role in the economy, as they minimize transaction costs between market sides and to their business models in the digital economy due to their adaptability and ability to handle complexity, rapid scale-up, and value capture. This success boils down to the network effects that they could achieve. For social media platforms, there are two network effects - direct and indirect/cross-side network effects. The direct network effect refers to people joining the social media platform due to its growing user base to connect with social interactions. The indirect/cross-side network effect deals with other actors such as advertisers or game developers joining the platform in hopes of reaching a broad reach of potential customers. It should be noted that social media platforms depend on this indirect/cross-side network effect to generate their revenue.

In "Governing Bad Behavior by Users of Multi-Sided Platforms', the author Evans (2012) notes that MSPs promote positive externalities between members of the community. The author also warns that there are numerous opportunities for users to create negative externalities that can reduce economic efficiency and cause harm. MSPs develop governance mechanisms to reduce harmful behaviour in the interest of making profits. They enforce these rules through the exercise of property rights and, most importantly, through the bouncer's right to exclude agents from some quantum of the platform including prohibiting them from the platform entirely. The author also notes that private control is likely to be more efficient than social control in dealing with negative externalities on platform communities because the platform owner can monitor bad behaviour more closely and deal with this behaviour more expeditiously than a public regulator.

Saurwein and Spencer-Smith (2020) in their research "Combating Disinformation on Social Media: Multilevel Governance and Distributed Accountability in Europe" utilise a risk-based approach along with descriptive, institutional analyses of governance arrangements, considering the existing institutions in the system of multilevel governance with prime focus on accountability. They identify producers and sharers of false information, social media users, social media companies and platforms and technology as key stakeholders in the system. With governments starting to take a greater role in framing policies against false information, they should also be considered as part of this system. In the research "Platform values and democratic elections: How can the law regulate digital disinformation?", Marsden et al. (2020) attempt to examine how governments can regulate the values of social media companies that themselves regulate false information spread on their platforms. Based on the research, the authors propose the possibility of six types of governance systems - status quo, non-audited self-regulation, audited self-regulation, formal self-regulator, co-regulation and statutory regulation. Of these governance structures, the authors prefer co-regulation as the best possible form of governance.

Hartley and Vu (2020) in "Fighting fake news in the COVID-19 era: policy insights from an equilibrium model" identified two mechanisms to tackle false information. The first mechanism deals with decreasing the cost to the social media user of making high effort relative to the low effort through media literacy. This works in conjugation with initiatives from social media platforms to use algorithms to detect fake news, crowdsourcing capabilities for detection and collaborating on research about the impacts of fake news. The government also joins in by providing guidelines and protocols for social media platforms, setting regulatory standards and enforcement. The second mechanism deals with reducing the user's consumer utility of engaging with fake news by promoting identification with increased ethical standards for social media user's personal social networks. Social media platforms should also create and promote a shared online standard of conduct regarding fake news treatment.

3

Research Methodology

3.1. Research Approach

The thesis follows a exploratory qualitative research approach that is done by analysing unstructured and non-numerical data, such as news articles and literature, focusing on the structure and context of COVID-19 infodemic and the perspectives of actors involved. A quantitative research approach is not preferred due to two main reasons. The first being, lack of available data as they are not readily available. The second being, the uniqueness of different types of false information. A qualitative analysis could better capture the nuances between these types than a quantitative analysis. A qualitative analysis of the institutional context of the social media information system is performed to compare different institutional rules under which the information discovery process varies, how they can lead to false information and how can reforms be implemented to combat COVID-19 false information in social media. The institutional context refers to systems of established and prevalent rules in which the social media information system is embedded. The proposed qualitative research approach requires a robust theoretical understanding of several concepts and theories. The abstract visualisation of the relation between theory and sub-questions can be seen in Figure 3.1. As shown in Figure 3.1, the literature review forms the basis of choosing the theory and for answering all four sub-questions.

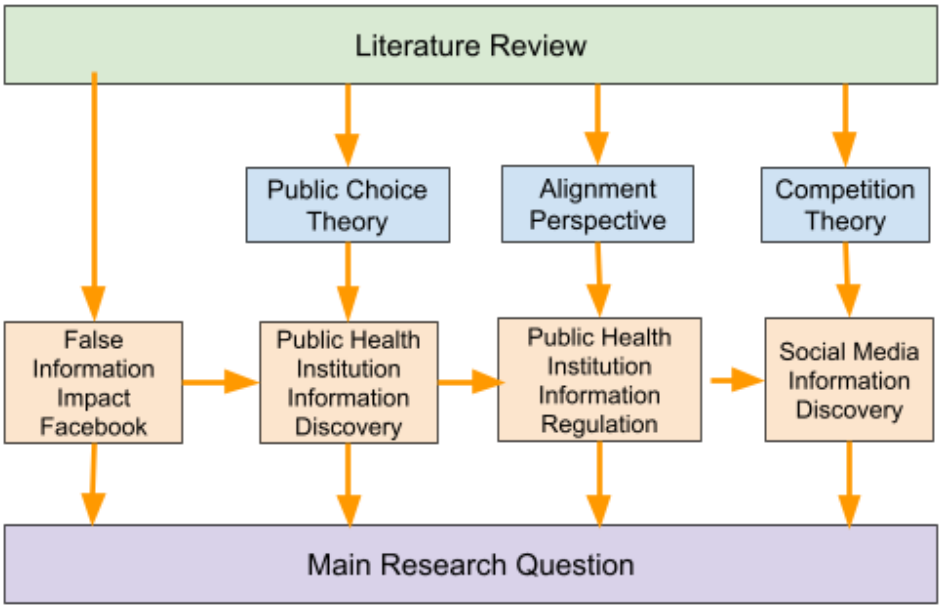

Figure 3.1: Abstract visualisation of the relation between theory and sub-questions

3.1.1. Theoretical Input

Three theories are used to answer the research questions. All three theories are part of the NIE school of thought. Two theories and one theoretical framework from this movement is used in this thesis. The first theory used is the public choice theory. The public choice theory acknowledges that actors are driven by motivations other than the general public well-being which affects the decision-making process. This affects how public health institutions make decisions on matters related to public health and how information is dispersed to the general public. The theory is used to answer sub-question 2. This should provide insights on other factors that influence the information discovery process of public health institutions and how it affects the medical recommendations made by such organisations. The theory is introduced and explained in sub-section 3.3.1.

This is followed by a theoretical framework called the alignment perspective. It is an adaptation of new institutional economics theory to a socio-technical system. The social media information system is a socio-technical system. There are rules in place which govern what kind of information is allowed on social media platforms and to enforce these rules, technology is utilised. The alignment perspective helps to analyse if the institutional rules governing the social media information system and the technology in place to enforce those rules are aligned with each other. The framework is used to answer sub-question 3. This should provide insights on the relevant stakeholders, the rules that exist, how it influences the governance structure and how information is regulated in the social media information system. The framework is introduced and explained in sub-section 3.3.2.

The last theory used is Competition as a discovery procedure. The theory explores how the information discovery process operates in competitive environments. It focuses on how the outcomes are uncertain and unpredictable such that they may or may not be useful. This is very relevant to how information is generated on social media platforms. This theory is used to answer sub-question 4. This should provide insights into what measures can be taken to disincentivize the spread of false information on social media platforms. The theory is introduced and explained in sub-section 3.3.3.

3.1.2. Approach to sub-question 1

The first sub-question is focused on establishing the impact of Covid-19 false information on Facebook. There are two ways to ascertain this. The first way is to identify the volume of COVID-19 false information. This is done using the literature. Facebook submits a monthly report to the EU commission on its measures used to combat COVID-19 false information in its platform. Another way is to identify the impacts of false information on people's response to the pandemic. This is done using the qualitative data gathered from the literature review. There are two outcomes. A graph showing the volume of false information on Facebook and a qualitative description of the impact of COVID-19 false information on the general public's response to the pandemic.

3.1.3. Approach to sub-question 2

The second sub-question deals with the institutional factors that influence the information discovery process of public health institutions. The question is answered by performing a case study analysis of three different cases of COVID-19 false information on social media platforms and applying public choice theory to it. These cases consist of different scenarios of COVID-19 false information such as COVID-19 severity, masks and false cures. The literature consisting of news articles and research papers are the main mode of input on the case scenarios and is subsequently evaluated using the public choice theory. The outcome should be a description of various non-medical institutional factors that affect the information discovery process of public health institutions and how they can contribute to false information online. This should also help in understanding the nuances to tackle different kinds of false information.

3.1.4. Approach to sub-question 3

The third sub-question deals with the institutional environment under which information related to COVID-19 is regulated on social media platforms. The second question showed how the information discovery process results in the information recommended by public health institutions. This information is used to regulate COVID-19 information on social media platforms. The alignment perspective provides an institutional framework used to structurally analyse how this works in the social media information system. The input for analysis is derived from academic literature and influential non-academic literature such as reports and

legislation. The outcome is an overview of various measures taken by different actors to combat false information, how technology is leveraged to enforce such measures and what are the disconnects that prevent such measures from effectively combatting false information on social media platforms.

3.1.5. Approach to sub-question 4

The last sub-question deals with the information discovery process on social media platforms and how it can be positively leveraged to combat false information from an institutional context. The question is answered using competition as a discovery procedure theory. Literature consisting of academic literature forms the main mode of input. A case study analysis using the same cases as discussed in the second sub-question is performed for the comparative institutional analysis. The evaluation using competition as a discovery procedure theory gives insights into the institutional factors that influence the information discovery process on social media platforms. The outcome should be a description of how COVID-19 false information on social media platforms can be disincentivised.

All four results from the sub-questions help in answering the main research question presented in section 1.5.

3.2. Research Methods

The research methods as denoted by Figure 3.1 are based on the research approach. The research methodology consists of two main methods: a literature review and case studies. These two methods help to answer the research question and sub-questions. As shown by Figure 3.1, sub-questions 1, 3, 4 and part of 2 are answered using the literature review. The case studies are used to answer sub-question 2. Following these, the answers are combined to answer the main research question which which is followed by results, discussion and recommendations. The following sections explain the choice for these methods and their working.

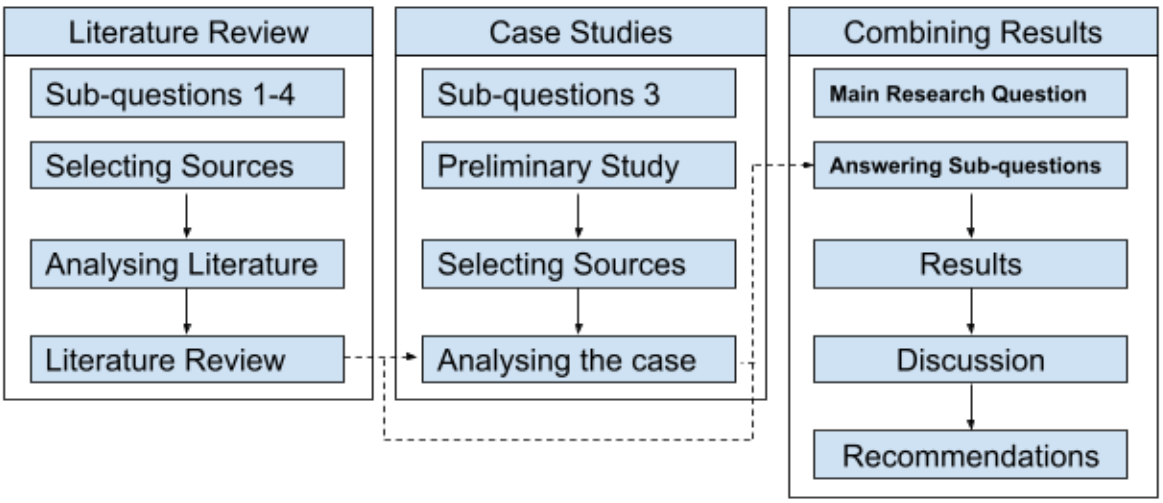

Figure 3.2: Steps in main methods of the performed research

3.2.1. Literature Review

A literature review is done to answer the first, part of the second, the third and the fourth sub-question. The literature review provides a structured and up to date overview of relevant topics necessary for this thesis. A literature review is a survey of scholarly sources on a specific topic often very helpful for researchers, as the reader gets an up to date and well-structured overview of the literature in a specific area, and the review adds value (Wee and Banister, 2015). They provide context and foundation, gain an overview of what is already written, show gaps or limitations, establish a framework, add credibility, identify and evaluate the strengths of different methodologies, theories and conceptual models.

The reason behind the use of literature review is that it offers a methodical and practical approach. Firstly, it allows answering the sub-research questions which are descriptive in nature. Secondly, it offers a structured

method to validate the choice of theories used in this thesis. There are other practical benefits as well. It helps gain a substantial amount of knowledge in the research area, position the research in existing academic literature and provide guidance in performing case study analysis.

The literature review is done on the following main subjects: COVID-19 infodemic, combat disinformation, public choice theory, alignment perspective and competition as a discovery procedure theory. It took a considerable amount of time to perform a comprehensive review of literature on all these subjects. To approach this, an interactive process for searching using key search terms in databases like Science Direct, Scopus and Google Scholar was used to identify gold-standard papers. Connected articles from these papers were also used. The selected sources were read and analysed for relevancy. Relevant findings are documented in chapter 2, section 3.3 and used for answering sub-questions. The result of the literature review is an array of literature that helps to answer the research question.

3.2.2. Case Studies

Case study analysis is used to answer a part of the second sub-question. A case study is a research strategy that involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple methods of data collection (Yin, 2008). As the method is explanatory in nature, it can be used to describe the COVID-19 information discovery process and the institutional context. Case studies were chosen because the method can be used to 'illuminate understanding of complex phenomena' (Harrison et al., 2017). This thesis aims to understand how the information discovery process varies between public health institutions and social media platforms from a comparative institutional perspective. This involves a complex social media information system consisting of many stakeholders. Without a practical perspective, there are two risks to the research. The first is that identified solutions might only exist in theory as the problem on paper might be different from the actual scenario. Secondly, nuances of the complex relationships between the stakeholders can go unnoticed which can result in losing valuable insights. The utilisation of case studies safeguards this research from these risks.

A case study analysis of three different themes of Covid-19 false information as noticed on social media platforms is performed. Based on the research by Shapiro et al. (2020), the three cases were chosen. In the study, a qualitative study on 5,613 distinct misinformation stories from the early days of the pandemic through the end of December 2020 has been performed. Based on the results, COVID-19 severity, masks and false cures are the three cases that are chosen for this analysis. The case studies should help to understand the different circumstances under which the information discovery process of public health institutions was influenced, how it contributed to false information on social media platforms and to identify underlying patterns or commonalities associated with the different scenarios of false information. Such patterns if identified can provide insights to frame effective policies to ensure the integrity of the information discovery process and eventually to combat false information on social media platforms.

3.3. Theories

This section presents the theories and theoretical framework utilised for analysis in this thesis. They help structure the research theoretically and show the scientific knowledge used in this thesis. Public choice theory, alignment perspective and competition as a discovery procedure are used in this thesis. They are presented in the sub-sections below.

3.3.1. Public Choice Theory

DiLorenzo (1988) defines public choice theory as the application of economic theory and methodology to the study of politics and political institutions. This definition is simplified by Shaw (2002) as the author notes that public choice takes the same principles that economists use to analyze people's actions in the marketplace and applies them to people's actions in collective decision making. This has been explained by Buchanan and Tullock (1999) in their book "The Calculus of Consent: Logical Foundations of Constitutional Democracy". The authors explain that economists assume that people are motivated mainly by self-interest when they study their behaviour in the private marketplace. Although most people base some of their actions on their concern for others, the dominant motivation is the concern for themselves. Public choice economists make the same assumption that people acting in the political marketplace have some concern for others but their main motive is self-interest. In Buchanan's words, the theory "replaces... romantic and illusory...

notions about the workings of governments [with]... notions that embody more scepticism". A similar sentiment is echoed from William A. Niskane in his book Bureaucracy and Representative Government that "[B]y 1964 1 came to recognize that there is nothing inherent in the nature of bureaus and our political institutions that leads public officials to know, seek out, or act in the public interest" (Simard, 2004). This approach to analysing collective decision making is opposite to the previously dominant school of thought - public interest theory which assumed that the actors in the political marketplace acted for the common good rather than in their own self-interest. Public choice theory is chosen over public interest theory as it recognises the rational self-interest behaviour of the actors.

To account for this change in approach Brennan (2021) explains that public choice economists do not ask what is the best policy but instead focus on what policy is likely to emerge from real-world democratic politics, and how that compares to the market alternatives. These questions have underlying assumptions on what kind of actor the government is and what motivates its decision. He opines that the former implies a benevolent despot conception of government while the latter puts the democratic electoral process centre-stage where it acknowledges that the decisions that the elected representatives make have electoral consequences and thus affect the decision making process. He highlights that the government is a complex social machine inhabited by people who are more or less the same as everyone else.

The government is concerned with policy-making while the bureaucrats are responsible for the implementation of these policies. For a successful implementation of policy, the government and the bureaucrats have to work in unison. As a result of self-interest behaviours by actors, Niskane in his book Bureaucracy and Representative Government highlights budget behaviour and bureaucratic supply of public goods as inefficiencies in the present system of decision making (Simard, 2004). He suggests that bureaucrats are rationally motivated to seek larger budgets as they are considered a sign of bureaucratic success and a source of comfort. The bureaucratic supply of public goods highlights a bilateral monopoly where the politicians depend on the bureaucrats for services, and the bureaucrats depend on the politicians for funding. Since bureaucrats are sole suppliers of information, they are at an advantage. The disadvantages of such a situation are explained through expert failure theory and Murphy et al. (2021) in “Expert failure and pandemics: On adapting to life with pandemics” applies this theory to the scenario of COVID-19. Institutional issues like siloing, monopoly of opinion, and high regulatory barriers to entry are contributing causes of expert failure. Another inefficiency in the system has been attributed to the “congressional dominance” model of bureaucracy (Shughart II, 2008). In that model, government bureaus policy preferences mirror those of the members of key legislative oversight committees. These committees have the power to constrain bureaucratic discretion by confirming political appointees to senior agency positions, mark up bureau budget requests and holding public hearings. The author reflects that evidence does suggest bureaucratic policymaking is sensitive to changes in oversight committee membership. Thus, this section highlights the need to understand the incentives and risks of various stakeholders in the decision making process to come up with any meaningful solutions.

Public health institutions are bureaucratic organisations that depend on the government for its budget, authority and functioning. They are headed by individuals who are rational and are driven by self-interests. Thus, utilising public choice theory makes practical sense to analyse the influence of non-medical factors on the information discovery process.This affects how public health institutions make decisions on matters related to public health and how information is dispersed to the general public. The theory also helps provide a rational explanation behind these influences. This takes the focus away from what is the best policy but instead focus on what policy is likely to emerge from real-world democratic politics, and how that compares to the market alternatives. The theory should provide insights on factors that influence the information discovery process of public health institutions, how it affects the medical recommendations made by such organisations and how it can contribute to false information on social media platforms.

3.3.2. Alignment Perspective

Klein (1998) in “New Institutional Economics” characterises New Institutional economics as an interdisciplinary enterprise combining economics, law, organization theory, political science, sociology, and anthropology to understand the institutions of social, political, and commercial life. In order to analyse the social media information ecosystem in a structured way, this thesis utilises an institutional perspective. Institutional refers to the movement of NIE, rooted in the works of Ronald Coase (1937, 1960) and Commons (1931).

Hodgson (2006) in his research "What are Institutions?" defines instituions as systems of established and embedded social rules that structure social interaction. They are required to coordinate activities of actors that engage in transactions. Mainstream economics had narrowed the scope of economics by leaving out the context of economic activity. NIE, however, attempts to extend this scope to the social and legal norms (i.e. institutions) as these are an important determinant for the economic activity itself. Mainstream economics typically compares real-world outcomes with the hypothetical benchmark of perfectly competitive general equilibrium. It is unsurprising, then, that actual market outcomes will come up short (Klein, 1998). The relevant question then is to identify what is a feasible alternative. NIE helps in identifying this feasible alternative. This has been described by Williamson (2000) and is represented in the figure 3.3. The focus of NIE is mainly on the second and third levels. The second level deals with the institutional environment such as the formal rules of the game and especially property rights. The third level is focused on governance, i.e. the interactions of actors and how governance structure aligns with transactions.

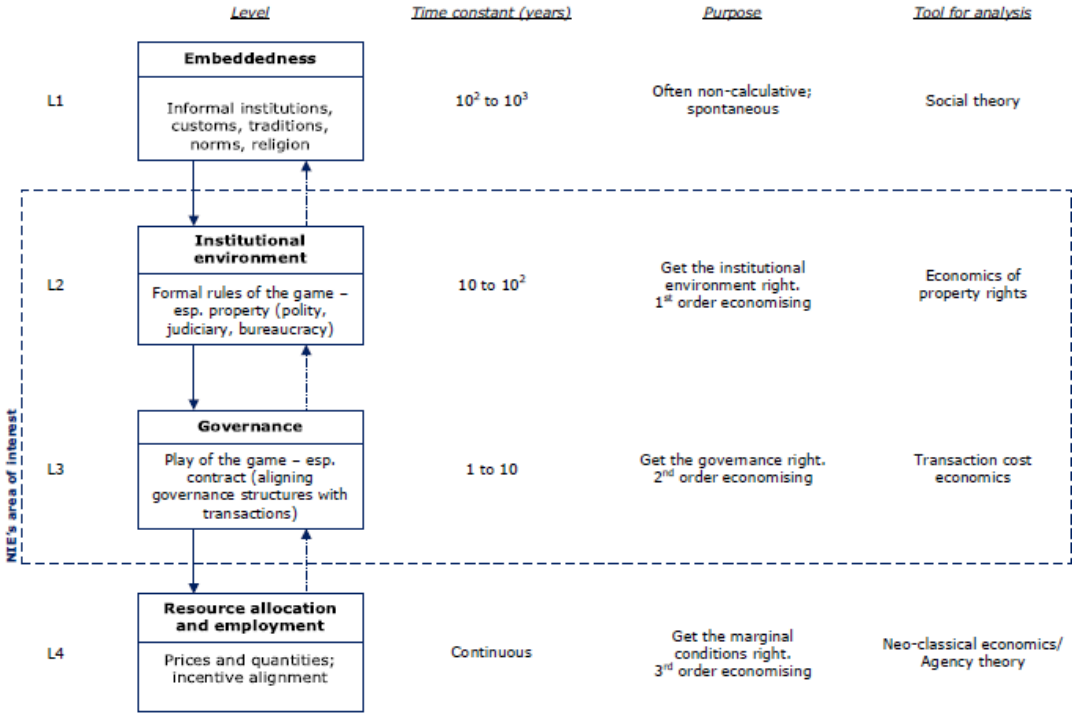

Figure 3.3: Four Levels of Institutional Analysis

There were gaps in the model proposed by Williamson. MÉNARD (2014) in his research "Embedding organizational arrangements: towards a general model" observed that NIE downplayed the complex interaction of institutions and organizational arrangements with technology. He identified that to build an integrated model of the interactions between institutions and organizational arrangements had to make room for technology. 'Criticality' was identified as a key concept to capture the interactions between institutions, organizational arrangements and technology. Criticality refers to the order in which transactions must be organized in a way that meets inescapable technical requirements such that network infrastructures can deliver the expected services with the highest possible quality at the lowest possible costs (MÉNARD, 2014). These critical transactions require coordination that is essential to guarantee that the requirements imposed by the technical functions align with the rights and rules embedded in the different institutional levels. This alignment perspective from MÉNARD (2014) is represented in the figure 3.4. Figure 3.4 shows that alignment issues are concerned with three independent levels. They are that the technological architecture must be embedded in adequate institutional rules and appropriate allocation of rights, rules specific to a sector and mechanisms of enforcement must be designed that are aligned with the specific technical characteristics of the sector and the choice of organizational arrangements will differ depending on the requirements of the technical operation of the system since these arrangements must be aligned with specific constraints.

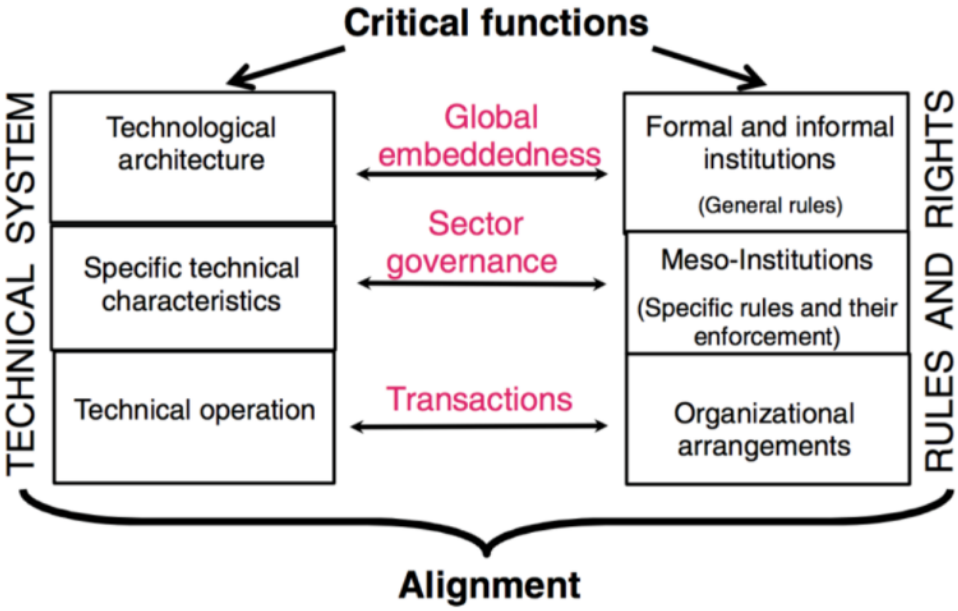

Figure 3.4: Alignment Perspective

This alignment perspective is adapted to the social media information ecosystem for the purpose of this thesis. In figure 3.4, on the right-hand side, the different levels at which property rights, as well as decision rights, are allocated is represented. They are:

1. The first level deals with the institutions in which the general rules are determined and/or embedded determine the broad allocation of rights and frame the behaviour of all economic entities operating within the jurisdiction of these institutions. For this thesis, the public health institutions is considered to play this role as it provides the COVID-19 information on basis of which COVID-19 information is regulated on social media platforms. For the purpose of this thesis, only public health institutions like WHO is considered.

2. The second level deals with the meso-institutions that get their legitimacy from a subsidiarity principle which allows them to transform the general rules into specific ones adapted to the specific technical characteristics of the system they frame and monitor, thus providing guidelines to actors and making rules enforceable. Governments of different countries are part of this level as they can decide on what aspects of the information they want to agree upon and enforce in their jurisdiction.

3. The third level deals with various organizational arrangements that actually operate within these rules, organizing actual transactions under constraints and possibilities opened by the technical system. All social media platforms are part of this level. They are bound to follow the orders of the government to enforce the regulation of COVID-19 information on their platforms. For the purpose of this thesis, only Facebook is considered.

Through these three levels, what is critical is the way rules are defined, implemented, and activated through the allocation and usage of rights among different parties involved. Similarly, on the left-hand side is the technological dimension with three different levels that characterize and differentiate technological systems providing support to different network infrastructures. They are:

1. At the first level is the architecture that defines technology and differentiates it from alternative solutions. In this thesis, this layer deals with the architecture of the social media platforms that allow monitoring of information like trends and accounts which post information.

2. At second level corresponds to the specific technical characteristics resulting from the adaptation of the technical architecture to specific physical circumstances. In this thesis, this refers to build-in mechanisms on social media platform to comply with the mandates of the government which includes monitoring of content, reporting standards, content regulating standards and identification of account holders through their IP addresses.

3. At the third level, these technical characteristics translate into technical rules making the system operational. In this thesis, this refers to the actual social media platform how it operates to collect different information, regulate information and present it to the social media user.

The social media information ecosystem is a socio-technical system. There are rules in place which govern what kind of information is allowed on social media platforms and to enforce these rules, technology is utilised. The alignment perspective helps to analyse if the institutional rules governing the social media information ecosystem and the technology in place to enforce those rules in a structured manner. The framework should provide insights on the relevant stakeholders, the rules that exist, how it influences the governance structure and how information is regulated in the social media information system.

3.3.3. Competition as a Discovery Procedure

Friedrich A. Hayek describes competition as a discovery procedure that arise from a lack of information in the market and whose outcomes are unpredictable (Snow, 2017). This competition can lead to information that can be a source of competitive advantage or lost cost. Bento (2014) combines this theory of competition with the model of Schumpeterian innovation where he describes the competition as the process through which many different ideas get generated but in the end, only the best ideas survive. These concepts have been taken and applied to non-market situations. Lucas (2020) in his research "Non-Market Competition as a Discovery Procedure" reviewed various applications of market process insights to non-market issues and designed a framework for non-market action as a competitive discovery procedure which is represented in figure 3.5. He conceptualizes nonmarket entrepreneurs as change agents whose actions alter the institutional environment at different levels of the institutional hierarchy which is based on Williamson (2000). This chapter deals with level 4 of this framework and adopts it to the context of false information in the social media information system.

	Level	*Nonmarket entrepreneurship*	*Description of entrepreneurial goals*
L1	Embeddedness—Customs, traditions, norms, religion	Cultural entrepreneurship	Entrepreneurs seek changes in society's customs, traditions, norms, and/or religion
L2	Institutional environment—Formal "rules of the game"	Constitutional entrepreneurship; institutional entrepreneurship	Entrepreneurs seek to change the "rules about the rules"—altering fundamental features of the formal institutional framework (e.g., creating and enforcing property rights)
L3	Governance—Play of the game	Public entrepreneurship, Political entrepreneurship (second-tier)	Entrepreneurs seek changes in the rules that govern action *within* the broader institutional framework
L4	Resource allocation and employment—Prices and quantities, incentive alignment	Political entrepreneurship (first-tier); Social entrepreneurship	Entrepreneurs arbitrage social and economic resources to engage in exchange with other actors *within* extant rules and norms

Figure 3.5: Nonmarket entrepreneurship and the institutional hierarchy

Level 4 deals with political and social entrepreneurship. It is driven by the competition theory and public choice theory. Political entrepreneurship is defined as "the purposeful action of self-interested individuals seeking to achieve their ends through the political process in the face of sheer ignorance" (Lucas, 2020). On the other hand, social entrepreneurs pursue the dual goals of economic value creation and social change through their ventures (Lucas, 2020). In context to the social media information system, the thesis considers

influencer entrepreneurs who engage with social media users to create their brand and profit off this brand. This profit can be seen in terms of building a reputation that may or may not be later used for monetisation through other means. The competition to address the information gap through social media platforms can be explained through this influencer entrepreneurship.

The theory explores how the information discovery process operates in competitive environments. It focuses on how the outcomes are uncertain and unpredictable such that they may or may not be useful. This is very relevant to how information is generated on social media platforms. This theory should provide insights into what measures can be taken to disincentivize the spread of false information on social media platforms.

4

COVID-19 False Information in Facebook

False information regarding COVID-19 has been rampant in social media. For this thesis, the focus is on COVID-19 false information on Facebook. This chapter should address the first sub-question "What is the impact of COVID-19 false information on Facebook?". The data presented in Table 4.1 is the official data that has been given by Facebook to the European Commission to transparently report the actions it has been taking against COVID-19 false information among many other things (European Commission, 2021a). The data represents the number of Facebook posts that were removed and labelled for COVID-19 false information from March 2020 to February 2021 worldwide and in the European Union.

Month	Removed - World	Removed - EU	Labelled - World	Labelled - EU
March 2020	7M	23K	98M	6.3M
April 2020				7.1M
May 2020				6.2M
June 2020				4.8M
July 2020	N/A	31K	N/A	4.1M
August 2020	N/A	36K	N/A	4.6M
September 2020	N/A	10K	N/A	4.4M
October 2020	810K	28K	27M	3.6M
Nov 2020	240K	10K	22M	3.4M
Dec 2020	401K	10K	19M	2.7M
Jan 2021	290K	13K	N/A	N/A
Feb 2021	570K	30K	N/A	N/A

Table 4.1: COVID-19 False Information on Facebook

Even though these numbers look large, it is essential to have the right perspective on these numbers. Some statistics show that Facebook has over 2.74 billion monthly active users and some estimations show that about 54,977 posts are posted on Facebook every second which includes photos, videos and written posts (Noyes, 2020). Compared to the numbers in these statistics, the numbers on the table look much paler in comparison. Based on the statistics, about 197 million Facebook posts would be generated every hour alone. Based on the available data, two graphs were generated to visualise monthly COVID-19 false information worldwide and European Union in Figure 4.1 and Figure 4.2 respectively.

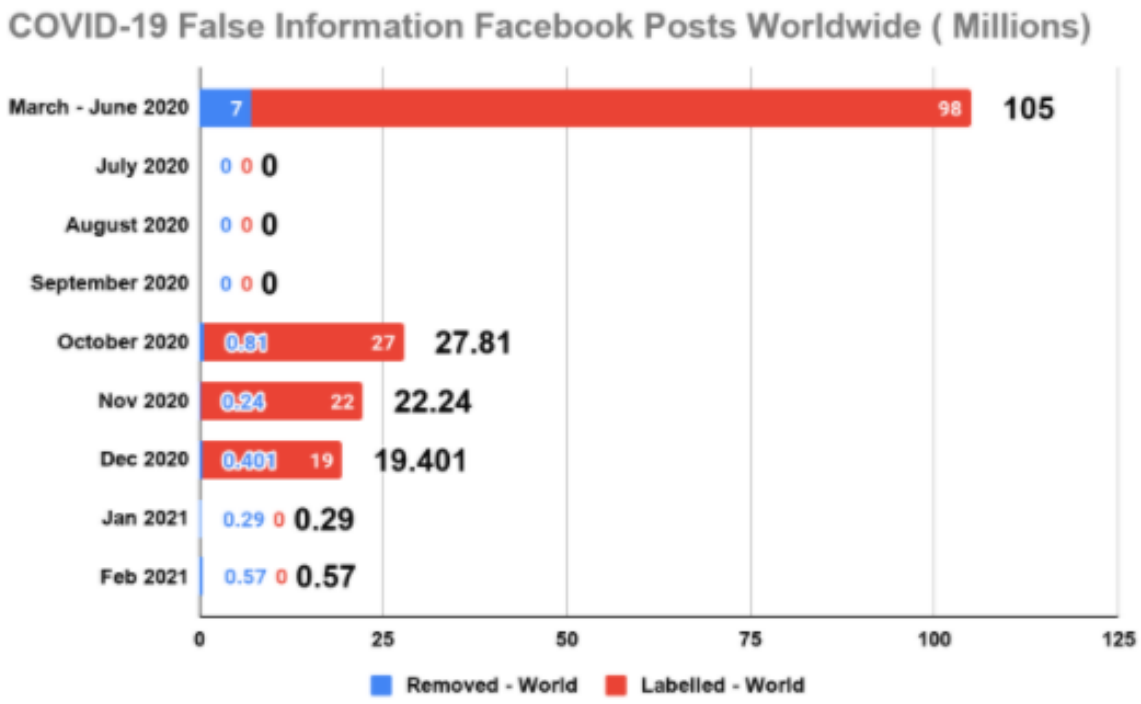

Figure 4.1: COVID-19 False Information Facebook Posts Worldwide in Millions

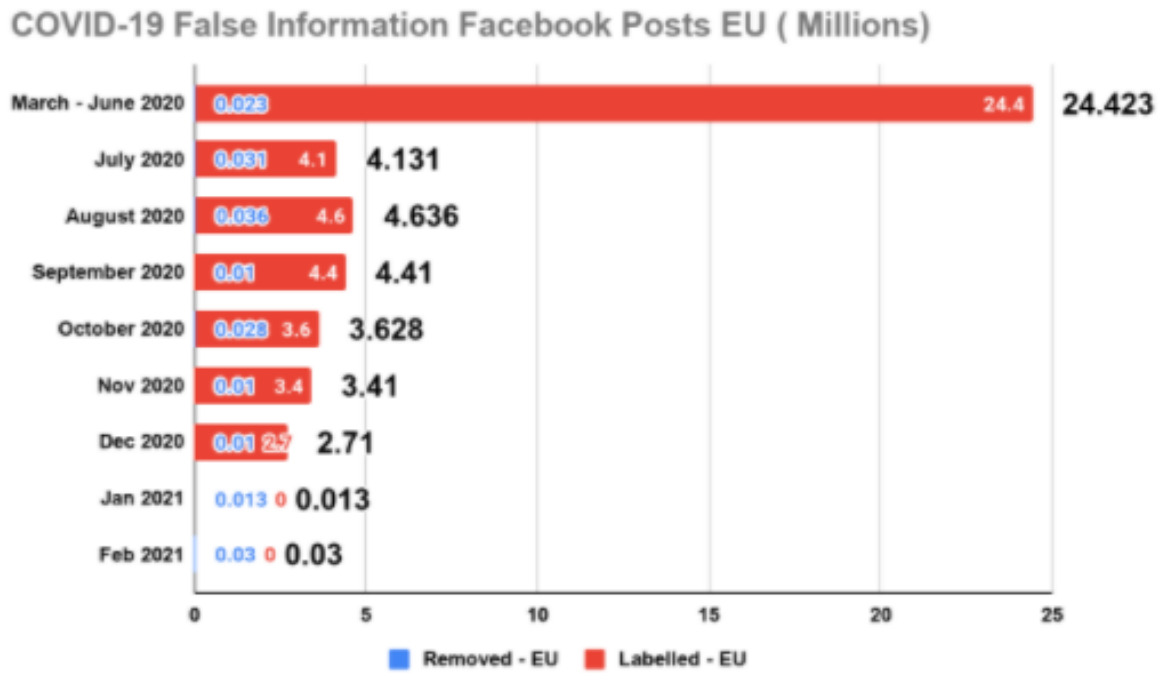

Figure 4.2: COVID-19 False Information Facebook Posts EU in Millions

Figures 4.1 & 4.2 represent the data in table 4.1 as a horizontally stacked bar graph which denotes the total COVID-19 false information for each corresponding month. The missing data in the table were considered as zero. The graph highlights that only a small number of posts were removed from the platform, but many misleading posts are still present on the platform. Such misleading posts are labelled as misleading and even contain links to official sources of information. This brings the question of how Facebook decides to label a

post as misleading. This is discussed in section 6.3. When it comes to public health, misleading posts can do harm. If people repeatedly come across misleading posts, it can affect the way they think and feel about the issue due to availability bias. Thus, it is concerning to see that many posts are being labelled misleading, instead of being removed. Another issue with labelling posts as misleading is the implied truth effect. It means that a social media user might be more inclined to believe a social media post to be true if it is not labelled as misleading even though that may not be the case (Pennycook et al., 2020). One also wonders if the debate on freedom of speech and expression on social media platforms has led to such outcomes. Facebook claims that 95 percent of the time, people do not go on to view the content that has been labelled with the warning that it contains misinformation (Facebook AI", 2020). This statistic might apply for posts that contain links to external websites but not sure if it takes into consideration of posts that contain images with false information as the user might not necessarily need to visit the external website. There is no clarity on how this applies to the specific case of COVID-19 false information.

Reflecting on the data has led to more questions. Comparing the number of Facebook posts per month to the posts removed and labelled for COVID-19 false information appears to be small. This leads to the question of how many COVID-19 related Facebook posts were posted each month as it will help in estimating the percentage of COVID-19 false information to understand the true magnitude of the problem. If the percentage is high, then the focus should be on removing such content, blocking or removing accounts that create and actively participate in spreading this false information. On the other hand, if this percentage is small, then the focus should be on why such a small percentage of the content is being viewed by many and how to contain it. In an interview, the CTO of Facebook Mike Schroepfer says that Facebook relies on third-party fact-checkers to identify false information, then use AI to find its flavours and variants (Perry, 2020). This shows how the process might be slow and very human dependent as someone has to flag the false information first and then the mechanisms in place to prevent its spread gets activated. This opens to a possibility that there may be many more posts that are not yet identified to contain false information. There might be assumptions that the posts which are not labelled are true.This effect is termed as implied truth effect and can have serious consequences (Pennycook et al., 2020). Pennycook et al. (2020) have found in their research that labelling verified information does help as it signals the social media user that the post has not yet been checked or verified. With this focus on false information, it triggers the question of what is true information then. If we are looking for false information, then we must know what is true. In the context of COVID-19, this has been challenging as the disease is novel and the information we know about the disease is evolving. Even public health officials had to change their stance as the knowledge about the disease has evolved which has put their handling of the crisis in the spotlight. This has fuelled distrust in public health institutions and the false information surrounding COVID-19 (Jaiswal et al., 2020).

The data is completely sourced from Facebook and as such should be accepted with a grain of salt. Like any other for-profit company, Facebook will use methods to process the data such that it will show the company in a favourable light as much as possible to protect its interests. Considering the time and resource constraints for this thesis, it is assumed in line with the popular public opinion that the COVID-19 false information is widespread on Facebook.

It is not possible to estimate the problem based on the volume of COVID-19 false information on social media platforms as demonstrated above. Instead, the impact of Covid-19 false information is considered to understand the magnitude of the problem. Misinformation can cause confusion, panic, fear and be pernicious. Aghagoli et al. (2020) in their research “COVID-19: Misinformation Can Kill” identified that false messages over time can erode public support and discourage adherence to evidence-based guidelines, foster mistrust in science and waste limited human and material resources. The research also notes that frequent exposure to false information can result in scepticism of truthful accurate content and the legitimization of misleading content. As a result, false information might be presented as one side of an honest debate, creating a false equivalence. Another consequence of COVID-19 false information is an increased risk for catastrophic but preventable outcomes. Roozenbeek et al. (2020) in their research “Susceptibility to misinformation about COVID-19 around the world” found that people susceptible to COVID-19 false information are likely to have hesitancy for vaccines and a reduced likelihood to comply with health guidance measures. This could result in difficulties in identifying disease outbreaks, taking measures to prevent and contain the disease transmission. Such behaviour does not only endanger the lives of people susceptible to misinformation but also those around them are put in danger. There are well-documented incidents of people consuming disinfectants to

treat COVID-19, refusal to wear masks and being vaccine-hesitant due to their interaction with false information on social media (Ahmed Siddiqui et al., 2020). This demonstrates that there are significant negative consequences of COVID-19 false information on social media. The impact of COVID-19 false information on social media is strongly evident and hence, it is necessary to find feasible solutions to address the problem effectively.

4.1. Conclusion

To conclude, the analysis of data provided by Facebook to the EU commission casts doubt on how widespread is false information on social media platforms. The data by Facebook gave insights on the quantity of false information related to COVID-19 in its platform but it appears to be a significantly small percentage when compared to the number of posts that are posted on the platform every month. Data on the quantity of information related to COVID-19 on the platform could give better insight. Since it is not possible to make clear conclusions based on the quantity of false information, the impact of COVID-19 false information is considered to understand the magnitude of the problem. It is strongly evident that COVID-19 false information has serious negative impacts on how people respond to the pandemic.

5

Case Study Analysis

In this chapter, a case study analysis of three different themes of Covid-19 false information as noticed on social media platforms is performed. This chapter should address the second sub-question "What institutional factors affect the information discovery process in public health institutions related to COVID-19?". The answer is based on the public choice theory which is discussed in sub-section 3.3.1. Based on the research by Shapiro et al. (2020), the three cases were chosen. In the study, a qualitative study on 5,613 distinct misinformation stories from the early days of the pandemic through the end of December 2020 has been performed. Based on the results, COVID-19 severity, masks and false cures are the three cases that are chosen for this analysis. The case studies can help to understand the different circumstances under which the false information evolved and the failures associated with the way the situation was dealt with to identify underlying patterns or commonalities associated with different kinds of false information. Such patterns if identified can provide insights to frame effective policies.

Based on the literature review, the public choice theory is chosen as a tool to analyse how the public health institutions acted in different circumstances. The public choice theory acknowledges that actors are driven by motivations other than the general public well-being which affects the decision-making process. This takes the focus away from what is the best policy but instead focus on what policy is likely to emerge from real-world democratic politics, and how that compares to the market alternatives. This can help provide insights to reform the present social media information system to combat false information effectively.

5.1. Case 1: COVID-19 Severity

In this case, COVID-19 false information related to its severity is analysed. During the initial stages of the pandemic, COVID-19 was very new and scientists around the world were trying to figure out how severe the disease might be. In the beginning, the disease was thought to be similar to flu based on available information from China where it all began. Over time, it became evident that the disease is more virulent, severe and deadly than the flu. Even after these new developments, the false information that the COVID-19 is like the flu spread on social media which divided people. This is dangerous as it can affect how people perceive the disease and take effective measures to protect themselves.

WHO failed to react proactively in this situation. On January 20, WHO sent a team to Wuhan and after two days ended its mission which was to determine if COVID-19 constituted as a Public Health Emergency of International Concern (PHEIC) inconclusive note (Crétois and Marbot, 2020). Only on January 30, WHO declared a PHEIC. This created a lot of confusion. As a result, many people questioned WHO's integrity. Donald Trump accused WHO to be "China-centric" and eventually cut off its funding (Kelland and Nebehay, 2020). To make the matters worse, the WHO chief made lavish public praise of China's leadership for its efforts to combat the disease came even as evidence mounted that Chinese officials had silenced whistleblowers and suppressed information about the outbreak (Kelland and Nebehay, 2020). Around the same time, on social media platforms, people were discussing severity of COVID-19. A doctor from China used social media to raise alarm on severity of the virus. Thus, on social media platforms, the right information was available. Independent Panel for Pandemic Preparedness and Response published a report later which concluded that

WHO should have announced PHEIC a week earlier and announce travel restrictions earlier as well (BBC News, 2021).

Analysing the situation of WHO using public choice theory, the activities of WHO makes sense and provides insights on some serious problems. A report suggests that WHO is underfunded with mandatory contributions of its members account for about 20% of the budget, while the rest comes from other countries at their discretion (Crétois and Marbot, 2020). This highlights the budget behaviour of WHO as China is the 15th highest contributor for WHO budget when compared to its 194 member states (World Health Organization, 2021b). Another problem is the structural issue of WHO. The WHO is funded and run by the same group of participating member nations that come under the agency's scrutiny. It does not have any multilateral regulatory or subpoena power, no skeleton key to access any country's intelligence vault (Pezenik, 2021). Thus, for effective functioning, they need to work together with other countries to get access to data, assess the situation and make recommendations that help other member countries to prepare themselves. This shows why it was necessary for WHO to work with China, praise them publicly such that they had access to necessary information.

The political leaders also aggravated the problem. US President Donald Trump admitted that he knew Covid-19 was deadlier than the flu before it hit the country but wanted to play down the crisis (BBC News, 2020). He has repeatedly mentioned that he wanted to show confidence and project strength. It should be kept in mind that this was happening close to the USA presidential election. The public choice theory shows that decisions that the elected representatives make have electoral consequences and thus affect the decision-making process. It was natural for the Democratic party to make a stand with the available science which pointed that the COVID-19 is severe. This resulted in political polarization of the American public. As evident by the very close election, the political polarization of the issue divided people sharply. Research by Milosh et al. (2020) suggests that political polarisation impedes the public policy response to COVID-19. The situation is further harmed by media biases towards the political parties as research suggests that behavioural responses of people were dependent on the news media they followed (Zhao et al., 2020).

The analysis of this case shows us the need to reform WHO especially in terms of its funding model and to give it more power to carry out independent investigations. The analysis also shows the dangers of political polarization of public health issues. The case also shows how public health institutions, political polarization and news media played an active role in promoting false information through their actions.

5.2. Case 2: COVID-19 Mask

In this case, COVID-19 false information related to wearing masks is analysed. During the initial stages of the pandemic, COVID-19 was very new and scientists around the world were trying to figure out how the disease transmits and how it can be prevented. In the beginning, the advice was that masks might not be useful in controlling the transmission of the virus. Over time, it became evident that the masks can reduce the transmission of the virus. Even after these new developments, the false information that the masks are not effective in preventing the transmission of COVID-19 on social media divided people. This is dangerous as it affects how people perceive the measure and take steps to protect themselves.

WHO contributed to the uncertainty related to masks. WHO's endorsement for masks arrived long after most nations urged their citizens to wear masks (Mandavilli, 2020). Even when it agreed to the usage of masks, it raised concerns of lack of direct or high-quality scientific evidence and published an exhaustive list of the potential disadvantages of wearing a mask such as potential discomfort which clearly sends a wrong message (Mandavilli, 2020). WHO even laid very restrictive guidelines on mask usage by healthcare workers and even rejected the evidence that N95s are far more effective than surgical masks (Mandavilli, 2020). These measures seem counter-intuitive as masks are an easy and inexpensive preventive measure. This raised concerns if WHO was taking this approach due to a shortage of masks. Similarly, Dr. Anthony Fauci, director of the U.S. National Institute of Allergy and Infectious Diseases and the chief medical advisor to the president who has served this role for a very long time has made admissions that the initial advisory against the use of masks was to prevent a shortage of masks early in the pandemic (Murphy et al., 2021). During the same time on social media platforms, there were a group of people especially doctors encouraging people to wear masks.

Analysing the situation from public choice theory, the situation is an example of expert failure. From the literature review, it has been identified that institutional issues like siloing, monopoly of opinion, and high regulatory barriers to entry are contributing causes of expert failure (Murphy et al., 2021). Dr. Anthony Fauci has admitted that he has altered his recommendations to achieve some alternative goal on multiple occasions. WHO appears to have done the same. This particular case appears to be an example of expert failure due to siloing. The experts acted from what they felt was best from their expert opinion but the issue is not solely an immunological one in which they have expertise. Issues of mask manufacturing and distribution are economic issues. Issues of how the public might react to this or that policy recommendation are matters of sociology, political science, and psychology. Thus, these immunological experts had to play the role of an amateur economist, sociologist, political scientist, and psychologist. Unfortunately, this siloed knowledge led to unexpected outcomes. An economist might have allowed the prices to rise to combat the shortage of mask supply but instead, by implementing price control, the supply for masks failed to increase with demand (Murphy et al., 2021). Similarly, if the experts announced publicly that the masks are in shortage and is reserved for the healthcare workers for the time being, they might have caused an uproar from some sections of the public but they would not have given room doubts regarding the need to use masks. Such an approach like sharing half-truths and working behind another agenda also creates distrusts in these public health institutions which can have dangerous long-term effects.

Like the previous case, the political leaders also aggravated the problem. US President Donald Trump has repeatedly mentioned that he wanted to show confidence and project strength. It should be kept in mind that this was happening close to the USA presidential election. The public choice theory shows that decisions that the elected representatives make have electoral consequences and thus affect the decision-making process. The Republican party framed the mandatory usage of masks as a fundamental rights issue to engage with their political base. It was natural for the Democratic party to make a stand with the available science which pointed that the masks can prevent transmission of COVID-19. This resulted in political polarization of the American public. As evident by the very close election, the political polarization of the issue divided people sharply. Research by Milosh et al. (2020) suggests that the single most important predictor of local mask use is not COVID-19 severity, demographic characteristics, religious affiliation, social capital or local policies such as mask mandates, but political partisanship. The situation is further harmed by media biases towards the political parties as research suggests that behavioural responses of people were dependent on the news media they followed (Zhao et al., 2020).

The analysis of this case shows us the need to reform how decisions are communicated to the general public by the public health institutions. It underscores the importance of transparency in the process and the need to restrict making recommendations just to medical issues. Experts in other sectors can deal with the after-effects. In this case, this means the public health institutions should have just focussed on recommendations related to the use of masks and should not have been concerned about its supply or the price. Relevant experts in those sectors should have been allowed to come up with viable solutions. The analysis also shows the dangers of political polarization of public health issues. The case also shows how public health institutions, political polarization and news media played an active role in promoting false information through their actions.

5.3. Case 3: COVID-19 Cures

In this case, COVID-19 false information related to potential cures is analysed. During the initial stages of the pandemic, COVID-19 was very new and scientists around the world were trying to figure out how can the disease be combatted effectively to save lives as it was believed that vaccines will take a longer time to be developed. In the beginning, there were no recommended methods for the treatment of the disease. Many combinations of drugs were tested. Over time, it became evident how certain combinations of drugs worked while others did not. Even after these new developments, the false information related to cures to treat COVID-19 on social media divided people. This is dangerous as it affects how people perceive the risks associated with the disease as an effective treatment plan gives a false sense of safety.

WHO has been criticized for being too cautious in making recommendations for the effective treatment of COVID-19 or its symptoms (Crétois and Marbot, 2020). This allowed doctors to use treatment plans that haven't been approved as it was recognised that they could provide their own treatments if they believed that

it could provide relief to patients (Crétois and Marbot, 2020). This meant that many different treatment plans were being used by doctors across the world as they tried their best to treat COVID-19 or its symptoms. At the same time, there was a surge in the use of alternative medicines to prevent and treat COVID-19 (Alvarez-Risco et al., 2020). Unproven prescription drugs were also falsely promoted for COVID-19 prevention and treatment which included hydroxychloroquine plus azithromycin, tocilizumab, or ivermectin (Alvarez-Risco et al., 2020). Some doctors promoted their treatment plans as an effective treatment for COVID-19 based on their anecdotal evidence while there were no research or research with inconclusive results or the research showed that the drugs were not really useful in the treatment of COVID-19.

Analysing the situation of WHO using public choice theory, it appears as if WHO was trying to protect its reputation. WHO is considered as an authoritative source of information regarding any disease as it has a network of people across the world which it leverages to produce accurate information. Maybe WHO didn't want to give a nod to treatments which it did not deem to be completely effective. Further, it might have taken a risk in the hopes that doctors could create their own treatment plans which could give a better treatment plan. If WHO had announced a particular treatment plan, then doctors would just follow that instead of coming up with their own treatment plan which could provide better outcomes as the disease was new and the knowledge about the disease was evolving. Another issue that was a cause of concern was the doctors making claims about certain treatment plans being effective without scientific evidence. The Dunning-Kruger effect explains that these doctors had utter belief in their own cognitive abilities which gave them the false sense that their speculation, and predictive powers, are more informed than the public health institutions (Weinman, 2020). The researchers attribute this to humans are not very good at uncertain situations and they apply their knowledge to make sense of the uncertainties. This misapplication of the knowledge and the need for certainty in an evolving pandemic resulted in doctors making public claims about the effectiveness of their treatment plans. Another reason could be that the doctors wanted to protect their reputation. Since there were no prescribed treatment plans, they used their own treatment plans to treat their patients. Some patients would have been treated successfully while others may have lost their life. If the prescribed treatment plan didn't approve their version of the treatment, it harms their reputation among their former patients and could raise more questions by the patients about the doctor's ability to effectively treat them. The problem here is the disconnect between some doctors and public health institutions. Doctors are the ones that interact with their patients on daily basis. Thus, patients are prone to trust their doctors more than someone fat away making statements to the media. This disconnect between doctors and the public health institutions could promote distrust of public health institutions and hence has to be addressed.

Like the previous two cases, the political leaders also aggravated the problem. US President Donald Trump has repeatedly mentioned that he wanted to show confidence and project strength. It should be kept in mind that this was happening close to the USA presidential election. The public choice theory shows that decisions that the elected representatives make have electoral consequences and thus affect the decision-making process. The Republican party wanted to promote cures as a sign that they had control over the pandemic. It was natural for the Democratic party to make a stand with the available science that pointed that such cures for COVID-19 were not effective. This resulted in political polarization of the American public. As evident by the very close election, the political polarization of the issue divided people sharply. The situation is further harmed by media biases towards the political parties as research suggests that behavioural responses of people were dependent on the news media they followed (Zhao et al., 2020).

The analysis of this case shows us the need to reform how doctors communicate against the advice of public health institutions. There should be a mechanism in place for doctors to raise their concerns against advice from the public health institutions as such public display of contempt could promote distrust against them. The analysis also shows the dangers of political polarization of public health issues. The case also shows how public health institutions, political polarization and news media played an active role in promoting false information through their actions.

5.4. Conclusion

From the case study analysis, it can be concluded that even though the false information was of different kinds, they had some common threads between them. These common threads provide insights into how dif-

ferent actors in the social media information system has to reform the way they make decisions and communicate. The public choice theory has helped to identify the institutional factors for public health institutions such as budget behaviour, lack of authority and expert failure among other things that affect the information discovery process and the recommendations made by these institutions. This adds to the uncertainty existing about COVID-19. Public health institutions have to be transparent in their decision making such that they tell the general public how and why certain decisions are being made. They have to restrict their decision making to their area of expertise. They also need to work on mechanisms to address the concerns of the doctors. Similarly, the government must take steps to address the political polarization of public health issues. They affect the way the general public react to government guidelines and how they perceived the pandemic. The case study also highlights the role of news media in propagating political polarisation. The analysis also shows that in all three instances there is a information gap due to uncertainty associated with COVID-19. Social media cannot be held directly responsible for false information on their platform. The false information on their platform is a reflection of the public sentiments and a result of the information gap associated with the uncertainty and novelty of COVID-19. The case study analysis has shown how public sentiments have been influenced and shaped by the actions of public health institutions, government, doctors and news media. The next chapter explores how the information generated by public health institutions are used to regulate content on social media platforms.

6

Social Media Information System: Alignment Perspective

The social media information system is a socio-technical system. It is not a stand-alone system. The information that exists on social media platforms is determined by rules embedded in the social and legislative or institutional context. This chapter should address the third sub-question "What is the institutional environment under which information related to COVID-19 is regulated on social media platforms?". The alignment perspective helps to analyse the institutional rules governing the social media information system and the technology in place to enforce those rules in a structured manner. This is done at three levels as shown in section 3.3.2 with the focus on regulating COVID-19 false information.

6.1. Global Embeddedness

Global embeddedness refers to the first level of alignment perspective between formal and informal institutions and technological architecture. Public Health Institutions like WHO is representative of formal institutions that determine what information related to COVID-19 is true. Public Health Institutions are science-based governmental organizations that serve as a focal point for public health efforts, as well as a critical component of global disease prevention and response systems (Heymann, 2008). They play a vital role in sharing knowledge and informing the government with scientifically sound recommendations based on available information for public health emergencies. World Health Organization, Centre for Disease Control are some of the examples of public health institutions. Since they deal with a public health emergency, one might wonder then why are they important in the context of combating false information. WHO Director-General has said "We're not just fighting an epidemic; we're fighting an infodemic. Fake news spreads faster and more easily than this virus, and is just as dangerous" during his remarks at Munich Security Conference (World Health Organization , 2020). Public health institutions are the authoritative source of information for public health. False information dilutes their messages and has an impact on how the general public adhere to their recommendations which has a greater impact on how public health emergencies can be resolved.

WHO utilises a risk communication strategy to combat false information. The strategy helps in minimizing the spread of epidemics by filling the gap which is always felt between what experts think people need to know and what people want to know (Vaezi and Javanmard, 2020). The three elements of the communication strategy are described by Vaezi and Javanmard (2020) in "Infodemic and Risk Communication in the Era of CoV-19". The first element is to talk about what you know and what you do not know honestly and clearly. The second element is to listen to the community when talking about their fears and perceptions. The last element deals with the management of rumours and infodemic as quickly as possible. Trust and accountability are key to effective risk communication. Without trust, people would not follow the given messages. To build trust, there should be in-time, easy-to-understand, transparent, and accessible services that are disseminated by multiple platforms and acknowledge uncertainty (Vaezi and Javanmard, 2020).

WHO's risk communication team launched WHO Information Network for Epidemics (EPI-WIN), to use a series of amplifiers to share tailored information with specific target groups to combat COVID-19 false in-

formation. About 20 staff and some consultants are involved in WHO's communications teams globally, at any given time. This includes social media personnel at each of WHO's six regional offices, risk communications consultants, and WHO communications officers (Zarocostas, 2020). The team monitors the social media platforms for some questions or rumours. They are noted and forwarded to the risk communications team and then they help find evidence-based answers. The team also works with social media platforms to direct inquiries related to COVID-19 to reliable sources. WHO is not just concerned with combating false information but also to produce content to keep the general public informed with recent developments.

WHO has also partnered with other public health institutions to combat the infodemic through infodemic management training. The idea behind the training is to train people locally with skills to manage infodemic and how they can utilise these skills to promote resilience of individuals and communities to the infodemic. This can lead to self-protective health behaviours by individuals and the community at large. Some of the key target competencies identified for infodemic managers are (World Health Organization, 2020b):

- Measure and monitor the impact of infodemics during health emergencies
- Detect and understand the spread and impact of infodemics
- Respond and deploy interventions that protect and mitigate the infodemic and its harmful effects
- Evaluate infodemic interventions and strengthen the resilience of individuals and communities to infodemics
- Promote the development, adaptation and application of tools for the management of infodemics

Public health institutions have considerable processes and resources in place to combat false information on social media platforms. The question here is how effective and fast they are in addressing false information. An important metric is the time taken for their decision-making process as the longer time they take, the more people are exposed to false information. Another important factor that has to be noted here is that they are only effective when people have trust in these institutions.

The technology architecture of social media platforms has features that allows public health institutions to monitor trends of false information related to COVID-19. This can be done through following trending topics and hashtags related to COVID-19. This allows public health institutions to put forth factual information to counter the false information on social media platform. This is done through coming up with the post based on defined processes. Social media platforms allow them to post content. This content can also be promoted to boost their views to certain populations which are at risk of being influenced by false information. They also have the ability to report false information found on social media platforms which are later removed or labelled to be misleading. This can have consequences to the account holder sharing posts of false information as well. From the technology dimensions, it is clear that there are mechanisms in place that aligns both the technical and institutional dimensions.

6.2. Sector Governance

Sector Governance refers to the second level of alignment perspective between meso-institutions and specific technical characteristics. Government frames policies and provides guidelines that affect the way other actors in the social media information system operate within its jurisdiction. They can decide which aspects of COVID-19 information released by public health institutions are acceptable to them and direct social media platforms to regulate such information accordingly. Governments have always had laws to combat false information many of which have been extended to the digital world. The specific actions taken during the pandemic build on existing disinformation counter-measures (Radu, 2020). The risks caused by the distribution of disinformation provide justification for regulation and governance (Saurwein and Spencer-Smith, 2020). The strategies used by several governments as studied by Radu (2020) can be summarised in the following three themes:

- Criminalizing malicious coronavirus falsehood
- Establishing special units to combat disinformation

- Providing guidance to social media companies

Criminalizing malicious coronavirus falsehood empowers authorities to arrest offenders which could lead to jail time and/or severe fines. The criminalization of false information is broadly defined and extends to prevention measures, quarantine, timing, and potential treatment for COVID-19 (Radu, 2020). There are concerns that direct regulation may lead to censorship (Saurwein and Spencer-Smith, 2020). This is problematic as it can erode the trust of the general public in the information they receive. Secondly, it is not easy to implement the law in practice. The person in question should be in the jurisdiction of the country which might not be the case due to the global nature of social media platforms. Thirdly, it is not easy to prove in a court of law that the person intentionally spread falsehoods. This results in high transaction costs to implement such a system.

Establishing special units to combat disinformation empowers the government to work with social media platforms to combat false information. This is done through monitoring social media platforms for viral false information and providing factual information. This can also extend to asking social media platforms to remove contents that they deem to be false (Radu, 2020). This again raises concerns about censorship. Another concern here is that having any government as the single or preferred source of information on social media is not desirable, as it may push citizens to search for alternative sources on platforms that are not filtering contentious information (Radu, 2020).

Another approach has been providing guidance to social media companies through self-regulation policies like the Code of Practice on Disinformation which is supported by the EU Commission. Such alternative modes of governance are generally preferred for the media sector due to concerns that direct regulation may lead to censorship (Saurwein and Spencer-Smith, 2020). The code adopts several measures to address disinformation. The code addresses scrutiny of ad placements, political advertising and issue-based advertising, the integrity of services, empowering consumers, empowering the research community and monitoring code effectiveness (European Commission, 2021b). Based on the assessment of the code over a year, EU Commission has provided guidance to reinforcing the Code of Practice on Disinformation in the following areas (European Commission , 2021):

- Larger participation with tailored commitments
- Better demonetising of disinformation
- Ensuring the integrity of services
- Improving the empowerment of users
- Increasing the coverage of fact-checking and providing
- Increased access to data to researchers
- Creating a more robust monitoring framework

Through this code of practice on disinformation, a transparency measure through joint communication “Tackling COVID-19 disinformation - Getting the facts right” has been launched to ensure accountability towards the public of the efforts made by platforms and relevant industry associations to limit online disinformation related to Covid-19. The following measures have been recommended under this measure (European Commission, 2021c):

- Initiatives to promote authoritative content at EU and at Member State level
- Initiatives and tools to improve user’s awareness
- Information on manipulative behaviour on their services
- Improving the empowerment of users
- Data on flows of advertising linked to COVID-19 disinformation on their services and on third-party websites

Since the start of the pandemic, national legislation meant to discourage the creation and spread of misinformation also served to create the conditions under which it is more likely for it to flourish by undermining legitimate journalism and eroding trust in institutions of authority (Radu, 2020). A model of self-regulation provides a better alternative. A private control is likely to be more efficient than social control in dealing with negative externalities on platform communities because the platform owner can monitor bad behaviour more closely and deal with this behaviour more expeditiously than a public regulator (Evans, 2012). This model can also evolve into a co-regulation model where the government and other stakeholders take measures together to combat disinformation which can be effective, sustainable and without the fears of censorship from the government. Such measures when compared to the measures like criminalization or being the only authoritative source of information can have a positive impact as it can increase trust in government institutions which can decrease the susceptibility to false information online.

The specific technical characteristic features in social media platforms allows the government to monitor trends of false information related to COVID-19. This can be done through following trending topics and hashtags related to COVID-19. To enforce the rule of law, it is essential to have the ability to identify and punish the law-breakers. The technical characteristics of social media platforms allow to identify social media accounts that propagate false information. This is then used to identify the account holder responsible for handling the social media account through their IP address. This is followed by appropriate legal action. From the technology dimensions, it is clear that there are mechanisms in place that aligns both the technical and institutional dimensions.

6.3. Transactions

Transactions refers to the third level of alignment perspective between organizational arrangements and technical operations. Facebook like any other social media platform have rules that govern the information present on their platforms. This is agreed by the social media users when they sign up on to the platform. For COVID-19 related information, the public health institutions and guidelines of the local government are taken as a reference to regulate information. The social media platforms the authority to monitor content, remove content that does not meet their community guidelines and temporarily or permanently remove accounts associated with repeated infractions. In “Governing Bad Behavior by Users of Multi-Sided Platforms’, the author Evans (2012) notes warns that there are numerous opportunities for users to create negative externalities that can reduce economic efficiency and cause harm. MSPs develop governance mechanisms to reduce harmful behaviour in the interest of making profits. They enforce these rules through the exercise of property rights and, most importantly, through the bouncer’s right to exclude agents from some quantum of the platform including prohibiting them from the platform entirely.

Facebook already has rules in place to counter false information on its platforms. The greater scrutiny around false information has made them enforce these rules better due to the demands of greater transparency and involvement of governments through initiatives such as the Code of Practice on Disinformation. As a result, Facebook is actively monitoring content on their platforms through a combination of third-party fact-checkers and AI to detect and label or remove false information from its platform (Perry, 2020). In the case of COVID-19, the third-party fact-checkers rely on the information shared by public health institutions to determine if the shared information is true or not. Facebook also leverages its community by empowering them to report false/harmful content on their platform through self-reporting mechanisms.

The measures taken in specific to COVID-19 false information as submitted by Facebook to the EU Commission as part of its first baseline report under Code of Practice on Disinformation is discussed below (European Commission, 2021c):

- Under **Coordinating Harm policy**, Facebook removes content that advocates for the spread of COVID-19 as well as content that encourages or coordinates the physical destruction of infrastructure, such as 5G masts. This also includes removing content coordinating in-person events or gatherings when participation involves or encourages people with COVID-19 to join.

- Under **Regulated Goods policy**, Facebook has taken steps to protect against exploitation of this crisis for financial gain by banning content that attempts to sell or trade medical masks, hand sanitiser, surface disinfecting wipes and COVID-19 test kits. The platform also prohibits influencers from promoting

these sales through branded content.

- Under **Hate Speech policy**, Facebook is removing content that states that people who share a protected characteristic such as race or religion have the virus, created the virus or are spreading the virus. This does not apply to claims about people based on national origin because Facebook wants to allow discussion focused on national-level responses and effects (e.g., "X number of Italians have COVID-19"). The platform also removes content that mocks people who share a protected characteristic such as race or religion for having COVID-19.
- Under **Bullying and Harassment policy**, Facebook removes content that targets people maliciously, including content that claims that a private individual has COVID-19 unless that person has self-declared or information about their health status is publicly available.
- Under **Misinformation and Harm policy**, Facebook removes misinformation that contributes to the risk of imminent violence or physical harm such as content relating to fake preventative measures or exaggerated cures.

Through implementing its policies, Facebook has removed and labelled misleading information on its platform as discussed in chapter 4. The question that remains here is that how effective is Facebook in removing false information. It has got the right policies but how quick is it in identifying false information, how many views the false information had before it was removed are some serious questions which require more data and transparency from Facebook. Facebook is taking many other steps to address COVID-19 false information on its platforms. Apart from having rules to regulate content on its platform, Facebook promotes user engagement with authoritative resources and tools to raise awareness, establishing Coronavirus Information Center, creating new tools to help health researchers track and combat COVID-19, providing people with additional context about the content they share and prioritizing original news reporting (European Commission, 2021c). Some of the measures such as removing content and deactivating accounts have faced backlash from certain groups as they deem that Facebook is stifling their freedom of speech and expression. Another issue with regulating content on the platform increases the costs associated with operating the platform which reduces profits. Sometimes advertisements are rejected which reduces income for the platform. The public scrutiny of the platform has ensured that Facebook takes an active role in regulating their content even though their bottom line may get affected.

The technical operations allows Facebook to monitor trends of false information related to COVID-19 on social media platforms. This can be done through following trending topics and hashtags related to COVID-19. To enforce the rules of the platform, there are technological features that allow Facebook to identify social media accounts that propagate false information. Once the accounts are identified, Facebook takes necessary steps that ranges from suspending the account until they comply with Facebook's policies or remove the account from their platform. Facebook also uses technology to leverage its user base to monitor and regulate content. Facebook provides the social media users the ability to report false content based on its rules. This content is then fact-checked through third party fact-checkers. Once the content is deemed false, AI is used to identify similar false information content on the platform and is subsequently removed. From the technology dimensions, there are mechanisms in place that appears to align both the technical and institutional dimensions. Is the alignment perfect? The answer is no. There have been concerns about how effective is Facebook's AI at identifying false information from other languages (Christopher, 2018). This demonstrates that even though it might appear that technology and institutional rules are aligned, it is not the case. Further, lack of availability of data on the actual extent of false information on social media platforms compared to the available information and the availability of performance metrics to identify how effective and fast the available mechanisms are to identify and remove/label false information on social media platforms makes it difficult to make definitive conclusions.

6.4. Conclusion

Analysing the social media information system using the alignment perspective has shown how powerless public health institutions are in combating false information on social media platforms. They rely on social media platforms to accept the directions offered by them to regulate content. Public health institutions are also dependent on governments to accept their directions. They cannot force governments to implement their suggestions but hope that the country accepts the knowledge that they share and comply accordingly.

The alignment perspective has shown that there are technologies in place that gives appearance of alignment with the institutional rules and laws to combat false information. Implementation of such technologies, new laws and regulations has not had any major impact on the presence or impact of false information online. This brings the next concern that the technologies should be improved to better combat false information. That may be true but there is no guarantee that they will completely solve the issue. People can just migrate to encrypted communication applications to continue spreading false information which can make it even more difficult to track them and address them. Many factors influence the ability to combat false information. Maybe technology is not the most effective factor to combat false information. The use of technology does not solve the real issue of why there is false information on social media platforms and why people get influenced by them. The technology does not help to combat false information actively as it can only act when it is known that there is false information activity as reported by another user and accepted by the third-party fact-checker. Similarly, removing false information might not be the right answer. Madsen et al. (2019) in their research "Source reliability and the continued influence effect of misinformation: A Bayesian network approach Anonymous" found that false information can retain influence even after the retraction of the source due to Continued Influence Effect. This suggests that improving technology to remove false information might not be enough. Another study "Causes and consequences of mainstream media dissemination of fake news: literature review and synthesis" suggests that most people hear about false information from their coverage in mainstream news outlets rather than from the false information source directly (Tsfati et al., 2020). This suggests that the right way to combat false information is to proactively address how false information begins and why people get influenced by them. To explore this, analysis is performed in the next chapter to identify how information is generated in social media platforms, what drives the users who are involved in the process and how this can be leveraged to combat false information.

7

Social Media and Information Gap

In the previous chapter, it is noted that there is a information gap due to the uncertainty and novelty of COVID-19. This information gap is further fuelled by slow decision making and contradicting communications by public health institutions and other actors as seen in the case study analysis. In this chapter, this information gap is explored in the context of how social media platforms have become a space to resolve this information gap, how it leads to the spread of false information and what can be done to resolve this. This chapter should address the second sub-question "How can the information discovery process on social media platforms be positively leveraged to combat false information from an institutional context?". The answer is based on a combination of competition as a discovery procedure by Friedrich A. Hayek and public choice theory as discussed in sub-section 3.3.3. Competition as a discovery procedure theory can help to explain the competition between public institutions and social media users who both want to resolve the information gap by getting the right answer first. Public choice theory helps explore the motivation and incentives of social media users who take part in this process.

As discussed in sub-section 3.3.3. In context to the social media information system, the thesis considers influencer entrepreneurs who engage with social media users to create their brand and profit off this brand. This profit can be seen in terms of building a reputation that may or may not be later used for monetisation through other means. The competition to address the information gap through social media platforms can be explained through influencer entrepreneurship.

As social media platforms grew in popularity and more people became active on such platforms, there was a discrepancy in the size of the networks each social media user had. Some social media users had few connections while some had a very large following. This led to classifying people with a very large following as influencers. These people were seen as people who could influence the decisions of other people as they attracted a lot of attention. This led to new ways of marketing and ultimately to influencer entrepreneurship where people intentionally produced content on social media platforms to attract a very large fan following which could later be monetised through a variety of means. One of the key activities of these influencers is to keep their followers engaged. With COVID-19 being part of every conversation, influencers had to take part in them.

With COVID-19 being new and unknown, there were many questions that needed answers. The case study analysis in the previous chapter showed how public institutions were slow to provide these answers to the general public. There was this information gap and everyone wanted to know more. Social media platforms were the right medium to reach many people at the same time and spread information quickly. To address the information gap, people from various backgrounds wanted to participate and social media platforms became an outlet for people to put forth their opinions which ranged from COVID-19 being fake to correctly predicting the dangers of COVID-19 before official information from public health institutions to creating panic. The Dunning-Kruger effect explains why people from various backgrounds had utter belief in their own cognitive abilities which gave them the false sense that their speculation, and predictive powers, are more informed than the public health institutions (Weinman, 2020). The right question here is to identify the motivations of people to share their opinions on social media platforms.

The motivations of people to share their opinions on subject matters that they are not really experts on can be attributed to the low cost of publishing their opinion to a wider audience, reputation, the need to be the first, followers and brand building. Social media platforms allow individuals to reach wider audiences that would not otherwise be possible at a very low cost. These individuals can reach many more people by promoting their content through advertisements which generally cost less and by their content shared by other followers. These individuals also are keen on maintaining their reputation among followers by engaging them with content that they need the most. There is also this need of being the first. Being the first person to predict something right means that they gain reputation and followers. Since COVID-19 is new and novel, no one knows what is right. There is uncertainty. These individuals can take the opportunity to gamble on this uncertainty. If they are right, they get the credit and if wrong, they can say there was a information gap and they are talking about one of the many possibilities. Another factor that plays into the equation is the follower base that the individual has. For example, if the follower base consists predominately of anti-establishment, the content that they produce will be related to that to satisfy their follower base. Lastly, influencer entrepreneurship is all about brand building. It is about how they present themselves to their followers, what kind of followers they attract and how the content they produce matches their brand. This outlines various factors that motivate many individuals on social media platforms to attempt to address this information gap. To better understand the consequences of such a information discovery process, a comparative analysis of the case study analysis is performed.

7.1. Case 1: COVID-19 Severity

In this case, COVID-19 false information related to its severity is analysed. During the initial stages of the pandemic, COVID-19 was very new and scientists around the world were trying to figure out how severe the disease might be. Due to the existing information gap and curiosity of social media users, a wide range of information related to COVID-19 severity spread on social media platforms. This ranged from assuming the virus was not being as severe to exaggerating the severity of the virus. Most of the information shared on social media platforms were false but a small minority of people shared the right information. Based on the research by Shapiro et al. (2020), some of the popular claims that underplayed the severity of the virus are:-

- Marc Siegel saying COVID-19 is just the like the flu.
- A story saying that in Italy no non-European citizens have been infected.
- Steven Hotze saying that people should just "live their lives normally".
- Jerry Falwell Jr. reopening Liberty University, saying young people do not have the conditions to be affected by the virus.

Based on the research by Shapiro et al. (2020), some of the popular claims that exaggerated the severity of the virus are:-

- Hand-sanitizer is useless against the virus
- Post making false claims about how deadly the virus is and how it spreads.
- Messages were spreads that the coronavirus was more lethal than other types of pathogens.
- YouTube video posted by a doctor claiming reinfection of COVID is fatal

During all this confusion, a minority of people shared the right information. Dr Li Wenliang from Wuhan used social media to warn others of the severity of COVID-19. There were others who predicted rightly how COVID-19 was getting transmitted. The analysis shows that a wide range of information related to COVID-19 severity was shared on social media platforms but only a small percentage of them were true information. This highlights a need for a mechanism to increase the chances of having this true information.

7.2. Case 2: COVID-19 Mask

In this case, COVID-19 false information related to wearing masks is analysed. During the initial stages of the pandemic, COVID-19 was very new and scientists around the world were trying to figure out how the disease transmits and how it can be prevented. In the beginning, the advice was that masks might not be useful in controlling the transmission of the virus. Over time, it became evident that the masks can reduce the transmission of the virus. In the meantime, due to the existing information gap and curiosity of social media users, a wide range of information related to the use of masks to prevent COVID-19 transmission spread on social media platforms. Based on the research by Shapiro et al. (2020), some of the popular false claims regarding masks are:-

- Post questioning the effectiveness of wearing masks to prevent the spread of COVID
- Face masks can be reused if steamed
- False interpretation of scientific claims leads to rumours that wearing a mask actually increases the risk of catching COVID-19.
- Hypoxia-induced pleurisy is occurring while using the mask.

During all this confusion, a minority of people shared the right information. They shared the need to use masks and their effectiveness in reducing transmission of COVID-19. Doctors also shared the right way to wear face masks. People also shared how they can make their own face masks using clothes at home. The analysis shows that a wide range of information related to COVID-19 masks was shared on social media platforms but only a small percentage of them were true information. This highlights a need for a mechanism to increase the chances of having this true information.

7.3. Case 3: COVID-19 Cures

In this case, COVID-19 false information related to potential cures is analysed. During the initial stages of the pandemic, COVID-19 was very new and scientists around the world were trying to figure out how can the disease be combatted effectively to save lives as it was believed that vaccines will take a longer time to be developed. In the beginning, there were no recommended methods for the treatment of the disease. Due to the existing information gap and curiosity of social media users, a wide range of information related to COVID-19 cures spread on social media platforms. This ranged from cures that were harmless to cures that could potentially be life-threatening. Most of the information shared on social media platforms were false but a small minority of people shared the right information. Based on the research by Shapiro et al. (2020), some of the popular claims that were harmless cures in the context that they don't do bodily harm are:-

- Sipping water every 15 minutes can prevent COVID-19.
- Eating garlic and drinking hot water as a preventative measure to COVID-19.
- Vitamin C cures COVID-19.
- Gargling saltwater and consuming vinegar are effective measures against COVID-19.

Based on the research by Shapiro et al. (2020), some of the popular claims that were dangerous suggestions and could potentially be deadly or cause bodily harm are:-

- Some QAnon conspiracy theorists claimed that bleach and 20-20-20 spray are good remedies against the virus
- Falsely claiming that hydroxychloroquine and azithromycin is a possible cure for COVID-19
- Consuming silver particles will not prevent or treat novel coronavirus
- Poisonous fruit of the datura plant was falsely promoted as a preventive measure for COVID-19

During all this confusion, a minority of people shared the right information. They were mostly doctors sharing a list of medicines that people suffering from moderate symptoms of COVID-19 could take to manage the disease without visiting the hospital. The analysis shows that a wide range of information related to COVID-19 cures was shared on social media platforms but only a small percentage of them were true information. This highlights a need for a mechanism to increase the chances of having this true information.

The problem with this setup for information discovery process is that there is a greater incentive to produce content related to COVID-19 but not enough incentive to produce the right content. Due to the fast and dynamic nature of the social media information system along with the number of participating individuals, the number and variety of content produced are very high. Due to the uncertainty associated with COVID-19, there is no way to effectively evaluate all the content. Granted that most of the content might be false or ineffective in adding value to the information gap related to COVID-19, there are content that has added real value to this information gap. There were a group of people who predicted the severity of COVID-19 right, the need for masks and models that estimate the number of COVID-19 deaths better than experts on social media platforms. Thus, there is evidence of content on social media platforms addressing this information gap. Here on the social media information system, there is this competition to grab people's attention and admiration. As with any competition, numerous ideas are generated which makes the outcome of competition unpredictable. The outcome of competition doesn't need to be always beneficial. In this competition, false information has won over the information that addressed the information gap. This can be attributed to too much attention given to false information and why people get influenced by them as discussed in the previous chapters. This should not negate the positive contributions that occurred through this competition where actual contributions are made to the information gap. This leads to the question of how can these positive contributions be made forefront of the information discovery process on social media platforms.

As discussed before, low cost and reputation are key drivers that allow individuals to freely participate in this competition to address the information gap without many consequences. To address the problem such that positive contributions are made forefront of the information discovery process on social media platforms, a mechanism should be used that can affect both the cost and reputation of individuals participating in these competitions. Prediction markets appear to be a mechanism that can be leveraged to address the issue. Prediction markets are "are markets where participants trade contracts whose payoffs are tied to a future event, thereby yielding prices that can be interpreted as market-aggregated forecasts" (Wolfers and Zitzewitz, 2006). Bryan Caplan coins and explains rational irrationality where individuals rein in their preferences over believes when they realize it is costly to be wrong but those same preferences can be given a free rein when it is costless to be wrong (Dourado, 2020). This implies that there will always be people to supply false information as long as there are people to believe in them. Prediction markets can remove the costlessness nature associated with false information on social media platforms. Individuals can be asked to bet on their claims in the prediction market which can be equated to asking these individuals to put their money where their mouth is. Tabarrok (2012) describes this bet as a tax on bullshit. This raises the costs associated with false information. The reputations of these individuals will be at stake as these individuals cannot make claims without participating in the prediction market as it would signal their followers that they are not confident in what they claim. At the same time, if they are participating in prediction markets, they will be forced to change their claims in light of new knowledge or risk losing money. Even if the majority of people do not participate in prediction markets, it can make people think critically of the information that they come across and how it affects such a market. This will help in identifying and flagging false information much sooner which could prevent their spread and reduce its influence.

7.4. Conclusion

The analysis using competition as a discovery procedure shows the motivation of social media users who generate content to address the information gap on social media platforms. The motivation factors are the low cost of publishing their opinion to a wider audience, reputation, the need to be the first, followers and brand building. The case study analysis shows the consequences of such a information discovery process. To disincentivise such individuals, measures should be implemented that affect both the cost and reputation of the individuals involved. The prediction market appears to be a promising tool to control how information is generated to address the information gap on social media platforms. In doing so, they can become an

effective tool to combat false information. This mechanism can also help highlight the positive contributions made by individuals in the social media information system and thus, help leverage the power of social media to solve real-world problems.

8

Conclusion

In this chapter, results, discussion and recommendations are discussed. The results deal with the answers to research questions while the discussion deals with insights from the thesis, its limitations and recommendations deal with recommendations of steps that can be adopted by different actors and for future research.

8.1. Results

In this section, the answers to sub-questions are discussed first and are used to answer the main research question. The first sub-question is **"What is the impact of COVID-19 false information on Facebook?"**. The approach to this sub-question is discussed in sub-section 3.1.2 and chapter 4 addresses this. To answer this question, first, it was decided to identify the number of social media posts that were removed/labelled as misleading by Facebook. This was achieved by using the official documents that Facebook submitted to the EU Commission as part of the self-regulatory code of conduct it had signed to. The results are presented in table 4.1, figure 4.1 and figure 4.2. The results show that there was a very high volume of COVID-19 false information on Facebook. However, on comparing this data with the average number of monthly new posts on Facebook, the number of false information posts appears to be small. To better ascertain this, more data is required specifically how many news posts related to COVID-19 is posted every month on Facebook. Since the data is not available, the impact of COVID-19 false information is considered to answer the research question. The research identifies that COVID-19 false information on Facebook has serious consequences such as it can reduce public support to measures against COVID-19, discourage adherence to guidelines, promote vaccine hesitancy, promote distrust and many more as documented in chapter 4. This supports the need and necessity to tackle COVID-19 false information on social media platforms.

The second sub-question is **"What institutional factors affect the information discovery process in public health institutions related to COVID-19?"**. The approach to this sub-question is discussed in sub-section 3.1.3 and chapter 5 addresses this. The purpose of this question is to identify the institutional factors that drives the decision-making process of different actors involved in the social media information system and how it can help propagate COVID-19 related false information on social media platforms. To answer this question, a case study analysis of three different themes of Covid-19 false information that appeared to be common on social media platforms is performed in chapter 5. The COVID-19 severity, masks and false cures are the three cases that are chosen for this analysis. The previous sub-question highlighted the need to understand how false information evolves and what causes people to get influenced by it. Public Choice Theory is used to analyse the cases to answer these questions. The analysis showed that the incentives in the decision making process were driven by the desire to avoid certain risks. Section 5.1 analyses the case of COVID-19 false information concerning the severity of the disease. The analysis showed WHO heavily depended on voluntary contributions of its members to fulfil its budget requirement and needed the cooperation of its members to conduct investigations that affect the way it interacts with the members and makes decisions. The government characterised by the politicians were making decisions that would appeal to their political base especially during an election year. The mainstream media having political biases contributed to this political polarization as well. Section 5.2 analyses the case of COVID-19 false information concerning the need for masks. The analysis showed WHO and CDC made decisions taking account of non-medical issues like the

supply of masks, their price and how the general public might react to such measures which these institutions might necessarily not have expertise on. As a result, publicly announced decisions were not necessarily in line with the actual medical advice. The government characterised by the politicians were making decisions that would appeal to their political base especially during an election year. The mainstream media having political biases contributed to this political polarization as well. Section 5.3 analyses the case of COVID-19 false information concerning cures for the disease. The analysis showed WHO either might have been concerned about its reputation as it was very cautious in its decision-making process or wanted doctors to try different combinations of drugs to come up with effective treatment plans. Some doctors might have been concerned about their reputation when their treatment plans were deemed to be not useful as they made public statements about the effectiveness of their treatment. The government characterised by the politicians were making decisions that would appeal to their political base especially during an election year. The mainstream media having political biases contributed to this political polarization as well. Even though the cases discussed false information of different kinds, they had some common threads between them. These common threads provide insights into how different actors in the social media information system have to reform the way they make decisions and communicate them to the general public. Another concerning common threads among the cases is that a small minority of social media users shared the right information before they were shared by public health institutions.

The third sub-question is **"What is the institutional environment under which information related to COVID-19 is regulated on social media platforms?"**. The approach to this sub-question is discussed in subsection 3.1.4 and chapter 6 addresses this. The purpose of this question is to understand the institutional environment under which steps have already been undertaken to combat false information on social media platforms. To answer this question, alignment perspective, an adaptation of new institutional economics to a socio-technical ecosystem is used. The alignment perspective allows exploring what rules are in place to govern false information at different levels and how does technology support the enforcement of such rules. This is essential as social media platforms work on sophisticated technology which needs to be understood to build controls, better optimize the process and ensure they meet the requirements that the regulation demands. Chapter 6 documents how the social media information system related to COVID-19 has three levels of governance structure and how technology supports governance measures at different levels. The first level is represented by Public Health Institutions. Section 6.1 documents how they determine the right COVID-19 information, provides the right information for fact-checking. publish right information on social media platforms and how they influence COVID-19 information regulation on social media platforms. They have defined processes which is a mix of risk communication strategies, working closely with social media platforms to identify trends of false information, communicate the right information and empower their partners to combat false information through infodemic management training. The chapter also presents that necessary technology architecture that is present to regulate the COVID-19 information on social media platforms. The second level is represented by the Government. Section 6.2 illustrates that government generally combats false information through criminalization, establishing special units to combat false information and provide guidance to social media platforms. The chapter also presents that necessary specific technology characteristics that is present to support such measures announced by the government. The third level is represented by Facebook. Section 6.3 documents how Facebook has rules, processes and measures in place to combat false information. Facebook has well-defined policies under which users can report false information, this is confirmed by third-party fact-checkers and AI is used to identify and remove similar contents. The chapter also notes that specific technical operations that are present to support Facebook in enforcing such measures. The chapter also presents that the necessary technology required for such operations is available to carry out the necessary processes. To conclude, there is an appearance of alignment between technology and institutional rules that govern the social media information system. Even though there appears to be an alignment, it is noted that the rules to govern false information have failed to combat false information. There is a possibility that existing technology should be better optimised and improved to be even more effective but technology does not help to combat false information actively. It can only act when it is known that there is false information activity as reported by another user and accepted by the third-party fact-checker. All the measures deal with combatting false information once it comes on to the social media platform. Social media platforms appear to reflect public sentiment. Thus to combat false information, there should be active measures in place that addresses peoples concern and not just removing false information from social media platforms.

The last sub-question is **"How can the information discovery process on social media platforms be positively leveraged to combat false information from an institutional context?"**. The approach to this sub-question is discussed in sub-section 3.1.5 and chapter 7 addresses this. The purpose of this question is to identify the drivers of false information on social media platforms such that measures can be taken to disincentivize them. To answer this question, a combination of competition as a discovery procedure theory and public choice theory is utilised. Chapter 7 documents the analysis and identifies the low cost of publishing opinions to a wider audience, reputation, the need to be the first, followers and brand building as motivating factors for social media users to participate in the competition to address the information gap. The concept of rational irrationality explains that there is no incentive for social media users to propagate the right information. The case study analysis highlights the need to have mechanisms that would result in a greater percentage of the right information. Low cost and reputation are identified as key drivers that allow individuals to freely participate in this competition to address the information gap without many consequences. To disincentivise them, prediction markets are seen as a possible solution. The prediction market could force social media users to make bets on their claims. Since there is a cost and reputation associated with it, they are incentivised to adopt their position with evolving knowledge. This can help combat false information as people would think critically of the information that they come across and how it affects such a market. This, in turn, could reduce the spread of false information and help leverage the power of social media to solve real-world problems. It should also be noted that a small section of social media users contributed positively to the information gap and hence they should be leveraged whenever possible. Prediction markets allow for this possibility.

The results from the four sub-questions are used to answer the main research question, **"How does the difference in the information discovery process between public health institutions and social media platforms contribute to false information on social media platforms from a comparative institutional perspective?"**. To answer this question, it is necessary to understand the social media information system, how widespread is false information in social media platforms, who are the relevant stakeholders, measures that they have taken to address the problem, why the problem persists and what drives false information in social media platforms. This understanding then provides insights on how the social media information system needs to be reformed to better combat the COVID-19 infodemic. The thesis identifies that there is no sufficient data available to determine how widespread COVID-19 false information is on Facebook as the number of posts removed/labelled appears to be a very small percentage of the total number of monthly new posts on the platform. Another study has identified that many people are exposed to false information by mainstream media in their attempt to invalidate claims made in the false information. The thesis also identifies various measures taken by different actors to combat false information and how they use technology to enforce the measures. These measures appear to only combat false information once they are on social media platforms but they are not effective in addressing what drives this false information and how the general public get influenced by them. The case study analysis has provided insights on what drives this false information and how the general public get influenced by them. Based on the thesis, the government, public health institutions and the mainstream media are the actors whose behaviour needs to be reformed in the social media information system than the social media platforms themselves. The false information on social media platforms is a reflection of public sentiment driven by distrust of public institutions. To combat false information effectively, it is essential to address what drives this distrust. The case study analysis has shown that mainstream media has to refrain from propagating political polarization, the political leaders should not politicize matters of public health, the public health institutions should be transparent about their decision-making process, should limit themselves to making decisions solely based on medical reasons and should be structurally reformed such that their decisions are not influenced by external factors. Modelling the behaviour of these actors that would result in promoting trust in public institutions among the general public, the social media information system could effectively combat the COVID-19 infodemic. The case study analysis also shows that the decision making process by public institutions is slow such that there is a information gap. There is a competition on social media platforms to address this information gap. The low cost of publishing opinions to a wider audience, reputation, the need to be the first, followers and brand building are motivating factors for social media users to participate in the competition to address the information gap. Low cost and reputation are seen as drivers that need to be disincentivised to combat the false information generated as a result of this competition. Based on the results from the four sub-questions, the differences between the information discovery process in public health institutions and social media platforms is presented in table 8.1.

Public Health Institution	Social Media Platforms
Centralised	Decentralised
One decision	Many opinions
Binary Outcomes	Probabilistic Distribution
Built-in Mechanism	No such Mechanism
Restricted	Unrestricted

Table 8.1: Differences in Information Discovery Process

Table 8.1 highlights the key differences in the information discovery process between public health institutions and social media platforms as a result of different institutional environments under which they operate. Public health institutions have a centralised information discovery process where they have defined processes to reach decisions on different issues. So for each different problem, they reach one decision that they believe is the best with the information and the situation at that moment in time. Thus, their outcomes are binary in nature. As such they may be either right or wrong. Since they have defined processes, there are built-in mechanisms to filter information such that they use only scientifically proven information. As such, the number of people who participate in this information discovery process is restricted. On the other hand, social media platforms have a decentralised information discovery process where individual social media users can share their opinions on different issues. So for each problem, there are many different opinions. Once these opinions are published, they might be regulated based on the social media platform's policies. Thus, the outcome of such an information discovery process is probabilistic distribution in nature as each opinion has a certain probability of being true based on evolving information at that moment in time. There are no mechanisms to filter the information before they get published on social media platforms. They usually get regulated once they gain traction or is identified by an AI algorithm to violate social media platform policy. In the case of COVID-19, this regulation is based on the information given by public health institutions. The number of people who participate in this information discovery process is unrestricted as anyone with a social media account can participate. This gives rise to interesting prospects as people with different specializations can offer different perspectives on the same problem.

As shown above, two different institutional environments result in two different information discovery processes. Both these processes have their own challenges. Chapter 5 showed that the information discovery process in public health institutions has its own flaws which could result in flawed information. Chapter 6 shows how this flawed information is used to regulate the COVID-19 information on social media platforms. There is a possibility that the right information exists in these platforms but might be removed or labelled false due to regulation. Once it is discovered that the information recommended by public health institutions is false, this could lead to anger, resentment and stoke anti-establishment sentiments especially when the right information on social media platforms is regulated. The problem is exacerbated by novelty and uncertainty related to COVID-19 as no one knows for sure what is right and wrong. Chapter 7 showed the motivations of social media users to be involved in the information discovery process on social media platforms. The analysis as presented in table 8.1 shows that there is a need for build-in mechanisms on social media platforms that would increase the probability of having the right information. Prediction markets can be seen as a possible solution that can help control the generation and spread of false information on social media platforms. They can help increase the probability of having the right information. This can eventually help leverage the power of social media to solve real-world problems. In this way, the social media information system can be reformed to better combat the COVID-19 infodemic. This is further discusses in section 8.3.

8.2. Discussion

Social Media has changed the way we receive and consume information. Before social media, there were only a handful of entities that provided information to the general public. Social media has changed that. It has empowered individuals to share their thoughts, how they perceive facts and share narratives different from those mainstream media. This system may appear appealing on paper as the truest form of democracy in action as people can advocate for what they believe in, people who agree can form consensus and take action. So what's the catch? The problem occurs when people are influenced by false information. This false information misleads people and could lead them to make decisions which they might not make if they had access to the right information. Thus, this makes the very idea of the truest form of democracy in action seem sinister. False information on social media platforms is a growing concern. It has real consequences like vaccine hesitancy, violence and affects the outcome of elections. The thesis aims at addressing how the social media information system be reformed to better combat COVID-19 false information. The analysis from a comparative institutional perspective focusing on the information discovery process between public health institutions and social media platforms has given many meaningful insights discussed in this section.

It is a common narrative to hear that false information on social media platforms is widespread. What does this mean? One might infer that a very large percentage of information on social media platforms is false. An analysis of the report submitted by Facebook to the EU Commission as part of its self-regulatory code shows that the volume of false information regarding COVID-19 is very less compared to the volume of new social media posts every month. This casts a reasonable doubt about such a narrative. Knowing the total volume of COVID-19 information on the social media platforms will provide a more definitive answer. Similarly, social media platforms are accused of spreading false information. The study by Tsfati et al. (2020) suggests that most people hear about false information from their coverage in mainstream news outlets rather than from the false information source directly. This raises the question if social media is alone responsible for spreading false information. A good example of this situation is the spread of QAnon conspiracy theory. QAnon was restricted to the fringe groups on the internet but gained prominence once it was picked by mainstream news media. The increasing coverage of QAnon also saw a rise in the number of people believing in the conspiracy and taking part in it. Political polarization and the political biases of mainstream media also helped to fuel its growth. Social media platforms allowed people to come together but the question is did these platforms caused this growth or the other actors in the social media information system. It appears to be the latter. Has the same happened during the COVID-19 infodemic as well? The results of the case study analysis appear to support it.

The results of the case study analysis demonstrate that the creation of false information and its influence on the people was due to the actions of the public health institutions, government and mainstream media. Public health institutions should make decisions only based on medical reasons as their advice and guidelines to the general public might differ from the right medical approach due to other factors. As a result, there is a lack of transparency in the decision making process and decisions are made behind another agenda which can cause distrust among the public. The analysis also showed the need to restructure the funding model and the powers of WHO such that it can operate effectively without undue political influence. The government which comprises of politicians and the mainstream media should not politicise public health issues. The analysis has revealed that the actions of these actors might contribute towards growing distrust of public institutions. The false information on social media platforms is a reflection of public sentiments. Removing false information may not be a solution but an aggravating factor as people might feel ignored or unheard. Thus, to effectively combat false information, this sentiment needs to be addressed and steps should be taken to model actor behaviour such that they do not contribute to false information.

Numerous measures have been taken by different actors to combat false information on social media platforms. Most of these measures deal with handling false information once it appears on social media platforms. The alignment perspective helps to reflect on both the institutional measures and how technology is being utilised to combat false information. The alignment perspective shows that technology and institutional measures to combat false information are appeared to be aligned with each other. This raises serious concerns on how effective technology can be in combatting false information under the present conditions. One might argue that technology can be better optimised. That may be true but it does not stop the inflow of new false information. The alignment perspective shows that technology may be one of the tools to address false information but it cannot solely address the problem. There are unintended consequences if one

thinks that strengthening current measures can combat false information effectively. Other than the issues with freedom of speech, there is a real concern about how such measures can be leveraged by authoritarian leaders to stifle dissent. This scenario leads to tough questions. For example, if a government claims that criticism towards its certain action is false, baseless and misleading, then are social media platforms obligated to remove such content as false information. In sense, the alignment perspective has shown that current measures and the use of technology are not proactive ways to combat false information. Then, one has to analyse how false information occurs in the first place and why people are influenced by them.

The case study analysis has revealed that how people are uncomfortable with uncertainty. The Dunning-Kruger effect demonstrates this as people used their cognitive abilities to make sense of the uncertainty which gave them the false sense that their speculation and predictive powers gave them a better understanding of the situation. In all three cases, it can be observed that there was always some kind of information gap which the false information tries to fill in. With COVID-19 being a novel virus, there was a lot of uncertainty that added to the problem. No one knew what is true with certainty. In a way, there was a competition between social media users and public health institutions to solve this uncertainty. In all three cases, public health institutions can be seen acting slow especially when compared with the dynamic world of social media. Thus, there is a competition for knowledge and a speed premium attached to it. When there is no certainty about what is true, one cannot dismiss information just because it comes from social media. For example, the lab leak theory regarding the origins of COVID-19 which was prominent on social media was widely dismissed until recently it is being seriously investigated. Similarly, during the initial days, many people other than experts tried to model COVID-19 deaths and were sharing their results on social media platforms. Some of the models had even more accurate predictions than the models developed by experts. This demonstrates the challenges of knowing what is true with certainty especially during an evolving pandemic. This leads to interesting questions as well. For example, should social media platforms restore information that claimed the origins of COVID-19 was through lab leak and should the information that was shared by public institutions against the theory being a plausible one be labelled or removed as it contains false information? Thus, this highlights the need to be transparent with the public, focus on building trust and ensure proper communication strategies are in place to connect with them. Sometimes, truth is not enough but the perception of truth is important as people comply only if they believe in what they think is true. Prediction markets appear to be an interesting solution that can challenge people to think rationally. It can force people to investigate the merits of their claims, provide the opportunity to adapt their claims with the evolving knowledge, take the spotlight away from why something is false information but instead change the narrative to why this claim appears to be more promising. At face value, prediction markets appear to be an effective way to combat false information. The possibilities are endless here as if they are successful, it can provide opportunities to leverage the power of social media to address complex real-world problems.

8.2.1. Reflection on Relevance

The thesis takes on a very current, relevant, challenging and complex problem. Attempts have been made to address the problem of COVID-19 infodemic from the ground up. This means analysis has been done from many the perspectives of many different actors to build a complete picture of the problem. As a result, the thesis has evolved into a comparative institutional analysis between the information discovery process of public health institutions and social media platforms. This is something new and not done before. The key contribution of the thesis is to identify the differences in the information discovery process between public health institutions and social media platforms and how they contribute to the infodemic. Identifying the key aspect of the problem helps in coming up with the recommendation that addresses the problem effectively. The thesis narrows down the problem to the lack of mechanisms to filter information on social media platforms to increases the chances of having the right information. Prediction markets were seen as a viable solution to this problem.

The thesis is academically interesting as it challenges many common assumptions. It highlights that there is a lack of consensus on actual understanding of the problem. A problem can only be resolved when the root cause of the problem is acknowledged. Social media platforms are seen as a problem. The thesis has shown that social media platforms are mere reflections of public sentiment. These platforms have rules and other necessary mechanisms to deal with false information existing on their platform. Thus, these platforms cannot stop new false information from being shared on their platforms. To address this issue is beyond the

scope of the social media platforms as they can act only when false information appears on their platform. Technology cannot help in such instances. Academia should look at other relevant actors such as politicians, mainstream media, public institutions in the social media information system and how they should model their behaviour to address the concerns of the public. The thesis also highlights how uncertainty can contribute to false information. The case study analysis shows that public health institutions are slow and restricted in their information discovery process when compared to social media platforms. Since there is no consensus on what is true, one cannot simply suggest all information on social media platforms to be false as there are many instances where social media platforms had the right information before the public health institutions. There is a competition and speed premium for information. Thus, it is an interesting problem for academia to reflect on how public health institutions can adapt to this challenge.

The thesis also makes contributions that have societal relevance. False information on social media platforms is of real concern and has serious consequences. The thesis discusses practical solutions that can combat false information effectively. Through the prediction market, societal knowledge can be leveraged to solve real-world problems. It can also force politicians to take note of issues that are of serious concern to the public. From a managerial perspective, the social media platform executives gain insights on how can they manage the information discovery process on their social media platforms such that it incentivises true information. Public health institutions are also made aware of how their information discovery process could contribute to false information. The executives are reminded of the need for transparency and the importance of making recommendations that reflect solely the medical facts.

The theories used in the thesis were very relevant. They provided the rigour and structure needed for the thesis. The public choice theory provided insights on motivations that affect the information discovery process in public health institutions. It highlighted that the information produced is not necessarily perfect as other agendas affect the outcome. This leaves open the question about what can be done to ensure that the information discovery process is not affected by external motivations. The alignment perspective provides a framework to present the institutional environment under with information is regulated on social media platforms. It highlighted the weak standings of public health institutions and how they are dependent on cooperation from government and social media platforms to remove false information and promote the right information. The role of technology is also questioned as the process appears to be more human-intensive in the beginning. This leaves open the question of how the institutional environment has to be restructured and how technology can be leveraged to regulate information on social media platforms effectively. Lastly, competition as a discovery procedure theory provides insights on what drives the information discovery process on social media platforms. This leaves open the question of how the spread of false information on social media platforms can be disincentivised.

8.2.2. Limitations

There are limitations to the thesis. The thesis is limited by access to adequate data which prevents it from making definitive conclusions. This can be seen in being unable to definitively conclude how widespread is false information on social media platforms. Data such as actual number of COVID-19 posts on social media platforms or the percentage of false COVID-19 information could have been much more insightful. Another data that could have been beneficial is key performance indicators for technology being employed to remove false information as it could give better insights on how technology can be better optimised. These limitations do not affect the outcomes of the thesis but could have provided better clarity.

This is not the first study on the role of institutions in the social media information system but it was the first occasion where alignment perspective, public choice theory and competition as a discovery procedure were used to analyse false information on social media platforms. In this sense, the study is explorative in nature. It explored the usefulness of these theories and the different perspectives it offers to better understand the problem of false information on social media platforms, why they occur, who might be responsible and how to better combat this issue. Due to the pioneering role of the study, there were no example frameworks to look at. Structure and creativity were required to ensure that the objectives of the thesis were met and to resolve or circumvent difficulties. Time constraints and information overload sometimes required the need to fit observations to the framework and there could be positive selection bias. These limitations do not affect the findings of this thesis as they have stemmed from literature.

Generalising the findings of the case studies to other false information might be problematic due to many different varying contexts. COVID-19 is very new, there was a information gap and there was a lot of focus on the issue. The situation was evolving quickly. The question then becomes does other cases of false information show similar characteristics or do the findings still apply for them irrespective of such characteristics. To be able to generalise the findings in this thesis, confirmation by further studies is needed. Hopefully, this thesis can act as a starting point for further research and contribute to the discussions around how to combat false information on social media platforms.

8.3. Recommendation

Based on the learnings and outcomes of the thesis, recommendations are made along with recommendations for future research.

The thesis explores a comparative institutional analysis of the information discovery process between public health institutions and social media platforms. The findings of the thesis provide insights for the recommendations. The information discovery process in public health institutions is not foolproof. Other institutional factors affect the medical recommendations being made by these institutions. This potentially flawed information is used to regulate information on social media platforms. On other hand, social media platforms have diverse opinions which could mean that some might actually be right. Thus, there needs to be a better way to regulate information on social media platforms that incentivises the right information instead of using potentially flawed information from public health institutions to regulate information. Prediction markets can be the solution. The findings indicate that there needs to be a built-in mechanism to filter information such that the probability distribution of various opinions on social media platforms favours the right information.

In prediction markets, people can bet on ideas. This forces people to act rationally as they would make calculated decisions not to lose money. There is also an additional risk of maintaining reputation as people would always like to be on the winning side of such bets. This could make people re-evaluate their opinions related to COVID-19 as new information comes to light due to a lot of uncertainty existing around COVID-19. The prediction market could help to filter out irrational opinions as people would likely not bet in favour of them. In this way, the probability distribution for the right information can be incentivised on social media platforms. Public health institutions can also monitor these prediction markets to analyse the types of false information that is gaining traction to provide the right information. The politicians instead of hindering or influencing the medical recommendations of public health institutions would instead focus on these institutions providing the right information before the consensus are reached on the prediction market. Instead of political complications that could arise from the advice of public health institutions, the focus could get shifted to the advice itself. As a result, the period of uncertainty could reduce and lead to less false information on social media platforms. This also has wider implications. It could lead to restructuring the way information is regulated on social media platforms. For example, do thrid party fact-checkers stay relevant if the prediction markets become successful. Another implication is an open-source approach to solving problems. Since prediction markets bet on ideas, can they be leveraged to collectively solve challenging problems instead of just getting to the right information. The prospects and implications of prediction markets look optimistic and interesting.

8.3.1. Future Research

As discussed in section 8.2.2, the thesis is exploratory in nature which means there are exciting opportunities for future research. The first research would be on examining the generalizability of the findings with other cases of false information. Another interesting research is establishing key performance indicators to identify how well social media platforms can combat false information. For example, the time taken to remove false information content, the number of times people interacted with false information content, the number of people who encounter similar types of false information and how frequently they encounter them are some interesting parameters to explore. It will be interesting to examine how much percentage of information on social media platforms is false information and what percentage of the total number of users interact with them. This can be then compared with the number of people who came across false information on mainstream media. This will provide better insights into how false information spreads. Further research is required to examine and reimagine how public health institutions can be restructured such that their fund-

ing model and the authority they possess can be independent of undue political influence. It will also be interesting to see how the general public react to public health measures if they perceive public health institutions to be independent of political influences. Lastly, research is required on how prediction markets can be effectively implemented within social media platforms to combat false information.

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