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STUDENTERRAPPORT

Dreams of Zero Hunger & the Power of Imaginaries:

A Techno-Anthropological Perspective on Food (In)Security in the Anthropocene

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Bjarke Jon Wasli, 20176360
Freja A.S.G. Neven, 20165146
Signe Bjerrekær Skov, 20211821

Supervisor: Anders Koed Madsen
Aalborg University, CPH
Technical Faculty of IT and Design
Department of Planning

Abstract

The purpose of this thesis is to investigate and explore sociotechnical imaginaries (STI) in an international setting, the United Nations sub-agency Food & Agriculture Organisation (FAO), how they materialise, are being performed in, and extended across, the globale. Furthermore, the aim has been to investigate how these STIs shape themselves to encompass the complexity of the problem of food insecurity. The thesis is based on data collected from the 71 annual flagship reports by FAO, 'State of Food & Agriculture', and functioned as a foundation for an historiographic inspired analysis to trace the development and evolution of the main STI of FAO, namely to eradicate world hunger. This investigation was facilitated by close and distant reading and utilisation of DistilBERT-modelling, in the framework of the slalom method and the complementary quali-quantitative approach. The data have been subject of analysis through an analytical framework consisting of feminist STS, based on theory from Sheila Jasanoff, Anna L. Tsing and Donna Haraway, namely: *Sociotechnical Imaginaries, Civic Epistemologies, The Anthropocene, Patchy Anthropocene* and *Situated Knowledges.* Through the analysis of temporal trends, it is found that the sociotechnical imaginary held by FAO, namely to eradicate world hunger, has remained the same through the years of 1947 to 2021. All while the way in which FAO attempts to achieve this STI changed over time.

Keywords: food (in)security, climate change, patchy anthropocene, sociotechnical imaginaries, civic epistemologies, situated knowledge, BERT-modelling, quali-quantitative, slalom method

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Overview of the Thesis

Before venturing into this master thesis, you will in this section be presented with a short road map, presenting all the different areas that you, the reader, will visit throughout. The thesis is divided into seven sections and aims at discovering the *sociotechnical imaginaries* that are present in the solution-making process regarding global food (in)security from an institutionalised perspective, namely the Food & Agricultural Organisation of the United Nations. But before being able to even make inquiries into this area, we have delved into the world to get a broader understanding of the hunger problem. Thus, section 1.0 Introduction will provide the reader with a short introduction to the anthropocene era with a focus on its impact on food security, the problem statement, and its context; as well as an introduction to the concept of food (in)security from the perspective of the United Nations (UN) and their sub-agency Food & Agriculture Organisation (FAO), in an effort to provide you, the reader, with a better contextual understanding.

The second section, 2.0 Literature Review, consists of the literature review. This literature review has had two purposes; First it has functioned as a point of entry into the field. This was done through an exploratory approach via multi-term co-occurrence visualisation to find a topic of interest for this master thesis. Secondly, the literature review has functioned as a means to get a fundamental and broader understanding of the field and the pre-existing literature surrounding it from a broad academic standpoint. This section consists of six subsections introducing topics identified in a multi-terms co-occurrence network of 9.930 articles from Scopus.

Following, in section 3.0 Theoretical Framework, you will be introduced to the theoretical framework of this thesis, namely Sheila Jasanoff's *sociotechnical imaginaries* and *civic epistemologies*. This has in combination with the literature review also functioned as inspiration for the creation of the problem statement. To complement Jasanoff, an introduction of the *anthropocene* and Anna Tsing's *patchy anthropocene* as well as Donna Haraway's notion of *situated knowledges* will be provided. Next, the methodology adopted within this thesis will be presented in section 4.0 Methodology. Here, you will be introduced shortly to digital methods, the *slalom method*, and the concept of the *complimentary quali-quantitative approach* as formulated by Anders Munk. The section will conclude with the methodologies

applied throughout the data collection and data analysis of this thesis; BERT-modelling and the concept of close and distant reading.

In section five, 5.0 Analysis, you will find the analysis of the findings with an outset in the presented theoretical framework. Section six, 6.0 Discussion & Reflections, provides a discussion of the findings as well as insights into the three authors's reflections of the entire research process. And lastly, section seven, 7.0 Conclusion, will provide an answer to the problem statement to conclude and sum up the findings of our master thesis.

This is the end of the road map. We hope it provided the overview needed to start your exploration of the topic food (in)security in the anthropocene.

1.0 Introduction

It is a bright and early morning in the Anthropocene. You wake up and give a good stretch. You roll out of bed, tired yet in good spirits. It is going to be another long and busy day at work, so you drag your feet to the kitchen to make yourself a coffee. You sit down on the porch, looking out on the tomato plants stretching for the sun, birds chirping away; enjoying the few moments of peace before the day really starts. You pull out your phone to catch up on the latest news from the world around you; *Breaking! The longest drought in Western Africa in 20 years, causing a new food crisis* (Mulvaney, 2022). No time to read the article in full, the day needs to be started.

Finally, you are home again, and the food crisis in Western Africa is still gnawing in the back of your mind, so you open your laptop to read the article from this morning, though instead you are hit with a new media report; *Breaking! Intense rain outside the monsoon season has caused serious flooding in India and southern parts of China* (Vaidyanathan, 2023) - while pictures of distraught people and their flooded homes and crops appear on the screen. Yet the next article provides you with the glorious news of how the United States have once again reached new heights in production output from their maize and wheat fields due to excellent climate conditions (USDA, 2021). As your day in the anthropocene is coming to an end, you close your eyes wondering about the absurdity of the unevenness in how weather phenomena affect different places in the world.

You wake back up. It is another bright and early day in the anthropocene. You get out of bed and make your coffee. Once again, the day offers new alarming stories of countries, humans, and ecosystems being ruined by extreme weather. And once again, your mind is filled and clouded by headlines and phrases such as; *Temperatures are rising and biodiversity is declining. Droughts. Wildfires. Extreme weather phenomena. Lack of rain, too much rain. Global food crisis* - and you worry for the livelihoods and the food systems that are yet again put under added pressure. The world seems to be in dysfunctional shambles, and scientists are telling us that we need to fix this disaster before the 'point of no return' in 2030, reducing global emissions by 50% (United Nations, n.d.-d). All the while also ramping up food production by 56% to feed a growing global population expected to reach nearly 10 billion people by 2050 (Ranganathan et al., 2018). The complexity, interconnectedness, severity, and

enormous scale of the issues all seem overwhelming. And the multi-layered and multi-dimensional nature of the problems all make it seem like an impossible feat to tackle. It makes you wonder; who is supposed to fix this, and how?

Well, the good news is that while scientists have been crying out for decades, the world is starting to wake up. The United Nations (UN), representing 193 nations worldwide, and their sub-agency being the Food and Agriculture Organisation (FAO), are today some of the main actors in the fight against climate change and are within that context tackling food (in)security on a global scale. With their Sustainable Development Goals (SDGs) developed in 2015 they have placed food (in)security as a top-priority with their second goal being "Zero Hunger" (United Nations, n.d.-b). But how exactly does the UN and FAO work towards this goal? How do they as a collective representing 193 different nationstates work on addressing these problems when climate phenomena impacts to such varying degrees depending on locality? And to what extent does the patchiness of so many different nations with different values, morals, technologies, customs, and practices, affect the proposed solution from FAO - and if so, how? These questions have inspired the work within this thesis and will be explored further through data-collection and processing with state of the art natural-language processing (NLP) models such as BERT (Bidirectional Encoder Representations from Transformers), while being subject to analysis through feminist Science, Technology and Society (STS) theory such as Sheila Jasanoff's notion of *sociotechnical imaginaries* (STI) and *civic epistemologies* (CE), Anna Tsing's work on the *patchy anthropocene*, as well as Donna Haraway's concept of *situated knowledges*.

1.1 Problem Statement

Before moving further into the depths of food (in)security and the formulated problem statement, a few brief conceptual definitions will be provided due to its theoretical nature to provide clarity regarding the scope of the thesis. All terms will be elaborated more in-depth in section 3.0 Theoretical Framework.

Sociotechnical Imaginaries refer to the collective and shared visions for the future that forms social life and social order, and its interplay with scientific and technological developments. *Sociotechnical imaginaries* (STI) focus on the fact that with the emergence of new science and technology, new possible visions of social futures for the collective good appear,

including risks and benefits. Thus, by looking at STIs one gets an understanding of sociotechnical systems as co-produced and their cultural meanings (Jasanoff & Kim, 2015).

Civic Epistemologies refer to the culturally specific ways in which the state tries to meet the expectations of the public on how to enact and implement expertise, knowledge, and reasoning in terms of decision-making. *Civic epistemologies* (CE) offers a way to analyse the relation between science, technology, and democracy, and their influence on the decision-making process within an institutional and organisational level (Jasanoff, 2005).

The Anthropocene refers to an era of human impact on ecosystems. Despite the complexity of the term and debate surrounding what it, in fact, encompasses, the term is used within this thesis to reflect contemporary society with a strong emphasis on the environment and human impact on this.

With those terms in mind, the problem statement was formulated as follows:

> *What sociotechnical imaginaries are, and have been, enacted in the institutional setting of the Food & Agriculture Organisation regarding the global problem of food (in)security in the Anthroposcenic era? And how are these sociotechnical imaginaries related to civic epistemologies and patchy locality?*

The aim of the problem statement, and thus the thesis, is to explore and understand sociotechnical imaginaries in a supranational setting, namely the UN sub-agency FAO, and how these imaginaries materialise, are performed in, and extended across, the globe. Furthermore, to investigate how these STIs shape themselves to encompass the complex and multi-dimensional problem of food insecurity, through an historiographic inspired approach to temporal trends, this thesis traces the development and evolution of the main STI of FAO, namely to eradicate world hunger.

To answer the problem statement, this thesis employs cutting edge digital methods in the form of DistilBERT-modelling in combination with close and distant reading in the framework of the slalom method as well as the complementary quali-quantitative approach. This functioned as a foundation for an analysis drawing upon feminist literature from the field of Science, Technology and Society Studies, specifically the concept of *sociotechnical imaginaries* and *civic epistemologies* to highlight the socio-technical-political dimensions of food insecurity,

the anthropocene and *patchy anthropocene*. This was done to highlight how FAO tries to encompass patchy locality to promote expansion of their STI in an era defined by climate change.

1.2 Context

This section will include a brief overview of the context of the studied field. The aim is to provide the reader with a better factual and contextual understanding of food (in)security and FAO and elaborate upon how these are intertwined and why they are relevant to examine in a contemporary setting.

1.2.1 Food (In)Security

For a better contextual understanding, it is important to first elaborate on what the term *food security* and *food insecurity* entail. Based on the 1996 World Food Summit, food security is defined as "when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (The World Bank, n.d.). Here, there are four different aspects to consider: Physical availability, economic and physical access, food utilisation, and stability. To ensure food security, these four conditions must be met. Food insecurity is oppositely when these conditions are not met and is defined as when someone "lacks regular access to enough safe and nutritious food for normal growth and development and an active and healthy life" (FAO, 2022). Food insecurity is measured at different levels of severity (mild, moderate, severe) by using the Food Insecurity Experience Scale developed by FAO (FAO, 2022).

The food (in)security situation in contemporary society is a complex one and varies greatly depending on the community, region, and country. However, on a global scale, considerable progress has been made in reducing hunger and malnutrition within the past decades.

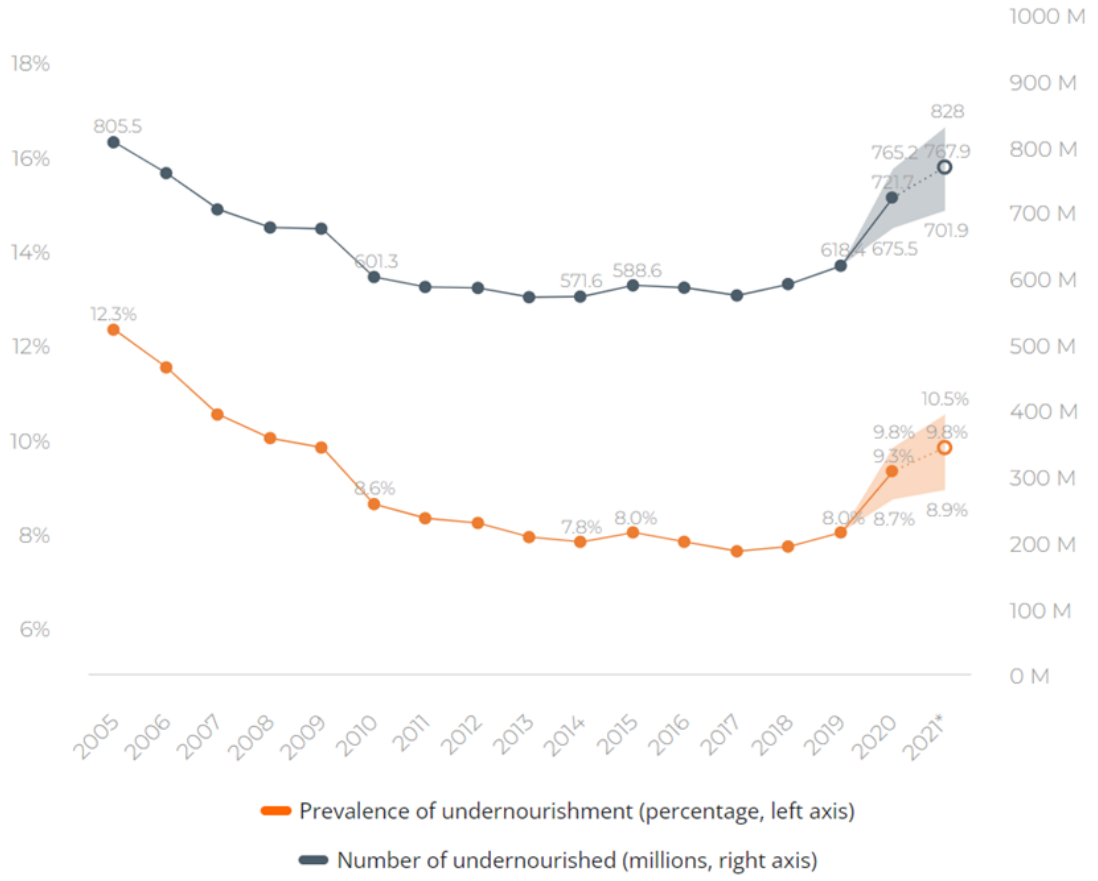

Figure 1: The State of Food Security and Nutrition in the World 2022 (FAO, 2022).

As seen on figure 1 above, world hunger has gradually been declining since 2005. However, since 2019 it has been on the rise again. According to FAOs latest report, the number of undernourished people grew by approximately 150 million people between 2019-2022 (FAO, 2022). And the numbers are expected to double by 2023 as compared to 2020 with more than 345 million people facing severe levels of food insecurity (WFP, n.d.).

The sudden spike in 2019 is partly attributed to the COVID-19 pandemic which exacerbated the situation with disruptions to food systems and economic downturns leading to increased food insecurity in many parts of the world. Though, FAO warns that the 2019 spike is only the beginning and an exemplification of how external factors (e.g. pandemics, conflicts, weather phenomena) can impede food security quickly and severely, thus the number of hungry people are expected to continue to rise. Particularly, in light of climate change and the accompanying changes in weather patterns such as droughts, heat waves, heavy rains, etc. which are expected to have great impact on crop production and overall food systems around the world, meaning we stand to face enormous challenges regarding food (in)security in the future.

Undoubtedly, facing these challenges requires complex adaptation strategies to ensure that everyone has access to enough, safe, and nutritious food in the future. Hence, global food security is a highly debated and prioritised topic within governments, civil society organisations, and other stakeholders, e.g. the UN being one of the frontrunners. The UN's involvement and acting role in regards to facing the challenge of global food insecurity will be presented in the following section.

1.2.2 The United Nations

The United Nations is an international organisation founded in 1945 as a result of the Second World War (WWII). 51 countries came together in an effort to commit to international peace and security while focusing on maintaining good relations to promote universal social progress. Here, we already get the taste of a collectively held STI promoting world peace and prosperity. As such, the Charter was formulated and operated as an international treaty in which the major principles are written down and in which member states are bound to adhere by law. Since then, the organisation has grown and is today comprised of 193 member states with the same Charter carrying the foundational principles (United Nations, n.d.-a). The UN describes their purpose as the “One place where the world's nations can gather together, discuss common problems and find shared solutions” (United Nations, n.d.-a). Because of the international nature of the organisation, the UN is able to operate and take action across a wide variety of issues on a global scale, thus serving its purpose as a platform for the member states to work together to address global challenges.

In an effort to address some of the major global challenges in contemporary society, and as a universal call to action, the UN came together in 2015 and formulated 17 Sustainable Development Goals, depicted in figure 2.

Figure 2: Sustainable Development Goals for 2030 (United Nations, 2015b).

The SDGs as seen above were designed to end problems such as poverty, hunger, biodiversity loss, discrimination worldwide by 2030, thus providing a framework for countries and organisations to work together towards a common goal. Particularly, goal number two will be of focus within this paper as it is labelled "Zero Hunger" and aims towards ending all forms of hunger and malnutrition by 2030 (United Nations, n.d.-f). The UN writes that "extreme hunger and malnutrition remain a huge barrier to development in many countries (…) often as a direct consequence of environmental degradation, drought and biodiversity loss." (United Nations, n.d.-b).

So while, as mentioned previously, there was a sudden spike in food insecurity on a global scale in 2019 due to COVID-19, the major concern for future impacts lie within the realm of climate change. The UN recognizes that this is a complex matter of affairs as actions in one area affect the outcomes in other areas, thus development and progress towards these goals must be "a balance of social, economic, and environmental sustainability" (United Nations, n.d.-f). While the UN works towards the "Zero Hunger" goal through a variety of programs and initiatives, the main agency responsible for improving access to food is the sub-agency called the Food and Agriculture Organization.

1.2.2.1 Food & Agriculture Organisation

As previously mentioned, FAO is a specialised agency of the UN responsible for tackling food insecurity and hunger on a global scale. They were formed simultaneously with the UN in 1945, hence they have a lot of initiatives and projects under their belt. Since their conception, they have worked on initiatives such as the World Census of Agriculture, the World Food Summit, and the World Food Programme. One of the more recent initiatives by FAO is the 'Zero Hunger Challenge' inspired by the "Zero Hunger" SDG. The Zero Hunger Challenge focuses on five core aspects: 1) Eliminate hunger, food insecurity and malnutrition, 2) Make agriculture more productive and sustainable, 3) Reduce rural poverty, 4) Ensure inclusive and efficient food and agricultural systems, and 5) Protect livelihoods from natural disasters (United Nations, 2013). Meaning, the main objectives of the Zero Hunger Challenge is to ensure everyone has access to nutritious food, to promote sustainable agriculture, to support small-scale rural farmers, and to develop crops resilient to climate change.

Another initiative is the 'State of Food and Agriculture' which is FAO's annual flagship publication. Meaning, every year they publicise a report that brings science-based assessments of important issues in the field of food and agriculture. Each report contains an extensive overview of selected topics of contemporary relevance regarding global food security (FAO, n.d.-c). These reports have been a valuable source in the data collection process within this research and will be subject to analysis later.

Overall, FAO's approach to addressing food (in)security involves a combination of short-term humanitarian assistance and long-term development initiatives aimed at promoting sustainable agriculture and improving food systems to ensure access to nutritious food for all. Exploring these initiatives may reveal specific actions taken on a policy level in the context of imagined technological and scientific solutions and changes to social order to the complex and wicked problem that is food (in)security within the institutionalised realm of FAO.

1.3 Situated Perspectives

In the following section the three authors of this thesis will present their situated perspectives on food (in)security and their interest in the field, as an attempt to foster transparency regarding normative interests and positions which can influence the research conducted.

Bjarke: My academic career has been focused on biodiversity, climate change and green transitions, with an STS perspective. The complexity that these three subjects entail, fascinates and horrifies me, and exploring ways to navigate and find the least wrong path to a brighter future for all the entities on this planet, seems to me to be a worthwhile occupation. I have been interested in the disparity of the global food system for a few years, without pursuing it in an academic capacity. I am puzzled by how we can sit on our little hill with booming stocks of food and super markets filled to the brim, while so many people live well below the line in the sand, that all member states of the UN have agreed is inhumane. For all the reasons above, it has been great to finally pull my head out of the sand and delve into food (in)security.

Freja: I have a general academic interest in how climate change affects different aspects of the world. I hold an interest in how the disparities of the world materialise themselves in different sectors, such as the disparity of how climate change consequences affect locally, as well as the disparities between various nations. In regards to the specific topic of food (in)security, I had limited prior knowledge before venturing into the process of writing the thesis. Thus, this has been a learning experience for me, filled with surprises of how interconnected the world is within the realm of food.

Signe: My personal and academic interests lie within the realm of gender studies, social equality, feminist theory, and the environment in an anthropocenic context. However, before venturing into academics I was fortunate enough to travel the world extensively, thus a great appreciation for, and sensitivity to, diverse people and cultures developed. This has allowed me to experience some of the worst (and best!) conditions the planet has to offer, which has motivated me to help make the world a better place. I have found my place in this puzzle to be through sustainable and responsible development of current and future technologies for the betterments of societies. Regarding my pre-existing knowledge surrounding food (in)security, it has been very limited, hence the process carries traces of a certain inquisitiveness.

2.0 Literature Review

The following section of the thesis presents a broad literature review of the topics present in academic literature regarding *food security*, *food insecurity* and *food technology* in relation to climate change. The literature review was undertaken as the first step in the process of writing this thesis with the aim of creating and providing ourselves and you, the reader, with a wider and more general understanding of the topics surrounding food (in)security. It functioned as a ground for exploration for the authors, which led to increased curiosity regarding the topic of food (in)security from an institutionalised perspective, in the form of FAO, this resulted in the formulation of the problem statement (1.1 Problem Statement); the literature review could be understood as ground zero. The literature review is divided into six subsections, first an introduction of the methodological approach undertaken, followed by five sections divided by topics identified in the literature through the multi-terms co-occurrence map created, which is based on 9.930 English-language articles from the database Scopus.

2.1 Methodological Approach

The corpus of this visual exploratory literature review is based on the abstract of 9.930 English-language articles from the database Scopus. The choice of database was partly based on Scopus being one of the largest and most widely recognized cross-disciplinary research publication databases in the English-speaking world, with a wide range of publications within many different academic fields and areas. Thus, it was decided to use this database to ensure the inclusion of a wide range of articles from different academic fields. Even though Scopus has a slight bias towards English-language literature, and towards academic fields of natural sciences, such as engineering, science and technology, it became evident, that despite this bias, Scopus also includes and contains a wide range of social science and humanities journals (Elgaard Jensen et al., 2019, p. 622), which appears in our map.

In Scopus different search inquiries and search strings were used, but we ended up using a combination of four search keywords “food security”, “food insecurity”, “food technology” and “climate change” (see appendix 1 for boolean string). The search for literature started with an initial search on “food security”, and based on the reading of multiple articles’ keywords, the other aforementioned search keywords were included in the search string. The

expanded search, and after limiting the results to English-language articles, a corpus of 9.930 articles was obtained.

The combination of the search keywords was done through the use of boolean operators such as AND and OR. As preparation for the search a schematic using the boolean operators was created (see appendix 1), due to us being interested in gaining a wide understanding of the use of 'food security', 'food insecurity' and 'food technology' in academic literature, we used the boolean operator OR, which denotes the union, meaning that the hits from the search contains articles that includes at least one of the desired keywords. The usage of AND finds the literature that functions as an intersection between the selected search keywords, in our search that being exemplified through the combination of 'food security' OR 'food insecurity' OR 'food technology' AND 'climate change', resulting in a corpus of literature related to the three first keywords in combination with 'climate change'. The boolean operator NOT, was not used due to its often-limiting impact and excluding affect throughout the search (Lund et al., 2014).

The articles' abstracts were downloaded as a CSV file, and then imported to the open source software, CorTexT[1] from which a co-occurrence of terms network was created. The terms extracted from the abstracts were used to create the network seen in figure 3. As mentioned, this network is a co-occurrence multi-term network (the multi-terms consists of up to three words) analysed on the specificity of the terms. Aiming at creating a network of multi-terms occurring with high specificity score in the corpus helped us reveal discursive patterns used in the literature collected (*CorTexT - Home*, n.d.). In this process extracted terms with no meaning-creation potential in relation to the topic of our thesis, such as the names of journals, methodological choices in research such as data collection methods and so forth, have been disregarded and deleted from the terms list that later was visualised as the network presented in figure 3 (see appendix 2 for protocol for figure 3).

By running a semantic analysis on the uploaded corpus, CorTexT can create a multi-term list, this process starts of with running part-of-speech (PoS) tagging throughout the corpus, PoS tagging "analyses the sentence of structure to attribute a word class to each of the terms found in a sentence (noun, verb, (...) etc.)" (Elgaard Jensen et al., 2019, p. 3). This process supports the researcher to identify and ignore redundant terms or words with little to no value when it

[1] https://www.cortext.net/projects/cortext-manager/

comes to meaning creation and analysis, such as 'the' and 'a/an'. Following PoS tagging, we utilised CorTexT's function of compiling lists based on their attributes, through this process a list of noun phrases was created (Elgaard Jensen et al., 2019), which is defined by the multi-term minimum frequency and length. Multi-term length refer to the amount of words that should be considered as a single multi-term in the corpus, in our case it was set to three; thus, the words 'climate change mitigation' or 'Sustainable Development Goals' would be considered as a single multi-term instead of three separate terms that would be visualised as separate nodes, instead of a single node in the network. The minimum frequency refers to the amount of times a multi-term should appear throughout the corpus before it will be included in the multi-terms list extracted, that later can be visualised; in our case it was set to four. This process is based on the statistical measurement, specificity score, of a multi-term. A term having a low specificity score means it is fairly evenly distributed across the documents in the corpus, whereas a high specificity scored term is very unevenly distributed in the corpus. Cortext is geared to weighing multi-terms with higher specificity scores as more important, due to: "the assumption (...) that we already know the theme of our dataset and thus its generic language and that the reason for employing semantic analysis is to discover discursive differences below this generic level." (Ethnographic Machines, 2020).

The map created of the academic literature surrounding food (in)security and climate change has been utilised as a foundation for further qualitative inquiry and for understanding the topic of food (in)security. Hence, as the aim of the literature review was to function as a foundation for further inquiry, a visual approach to the network called visual network analysis (VNA) was undertaken. The VNA approach is a technique that allows for analysis of a network based on its visual features, aiming at transforming "(...) the matrix of associations (the mathematical substance of any network) into an image that can be interpreted visually" (Venturini & Munk, 2022, p. 193). Through VNA three visual variables are employed; position, size and hue; size relaying ordinal information of the nodes and to render quantitative differences between nodes and edges, hue refers to the colouring of nodes and offers insights into the designation of categories within the network. VNA offers investigations into the landscape of the network, the density and volume of clusters consisting of nodes connected by edges that are weighted, and thus the positioning of nodes should always be interpreted in relation to other nodes (Jacomy et al., 2014; Venturini et al., 2021; Venturini & Munk, 2022). Through descriptive inquiry into data, VNA aims at creating new

questions instead of validating existing hypotheses, thus falling in line with the aim of the approach to literature review that was undertaken in this thesis.

The visual aspect of this network and its inherent exploratory nature stems from the idea that “more than numbers, images arouse intuitions and raise questions" (Venturini & Munk, 2022, p. 205). This perspective ties back to the visual variables that can be employed through VNA to create meaning and cluster layouts in general. Behind the creation of clusters in the map is the utilisation of force-vector algorithms that allows for three-dimensional networks to be visualised in a two-dimensional space. This process was undertaken in the software Gephi (Bastian et al., 2009). In the creation of the network visualised in figure 3, the algorithm ForceAtlas2 was deployed, this algorithm employs a repulsion force for nodes and an attraction force for edges; this influences the positioning of nodes in relation to other nodes, and the edges, which are the connections between nodes. In other words, multi-terms that are interconnected are placed in close visual proximity, these close connected nodes, are called clusters (Jacomy et al., 2014).

Even though an exploratory approach to the literature was undertaken, the three authors quickly came to the realisation that we all had a normative interest in food (in)security from an institutionalised perspective. Thus, the following literature reviews initially present the institutionalised cluster, followed by an introduction to the other topics present in the literature review map, yet with a focus on their connections to the institutionalised cluster.

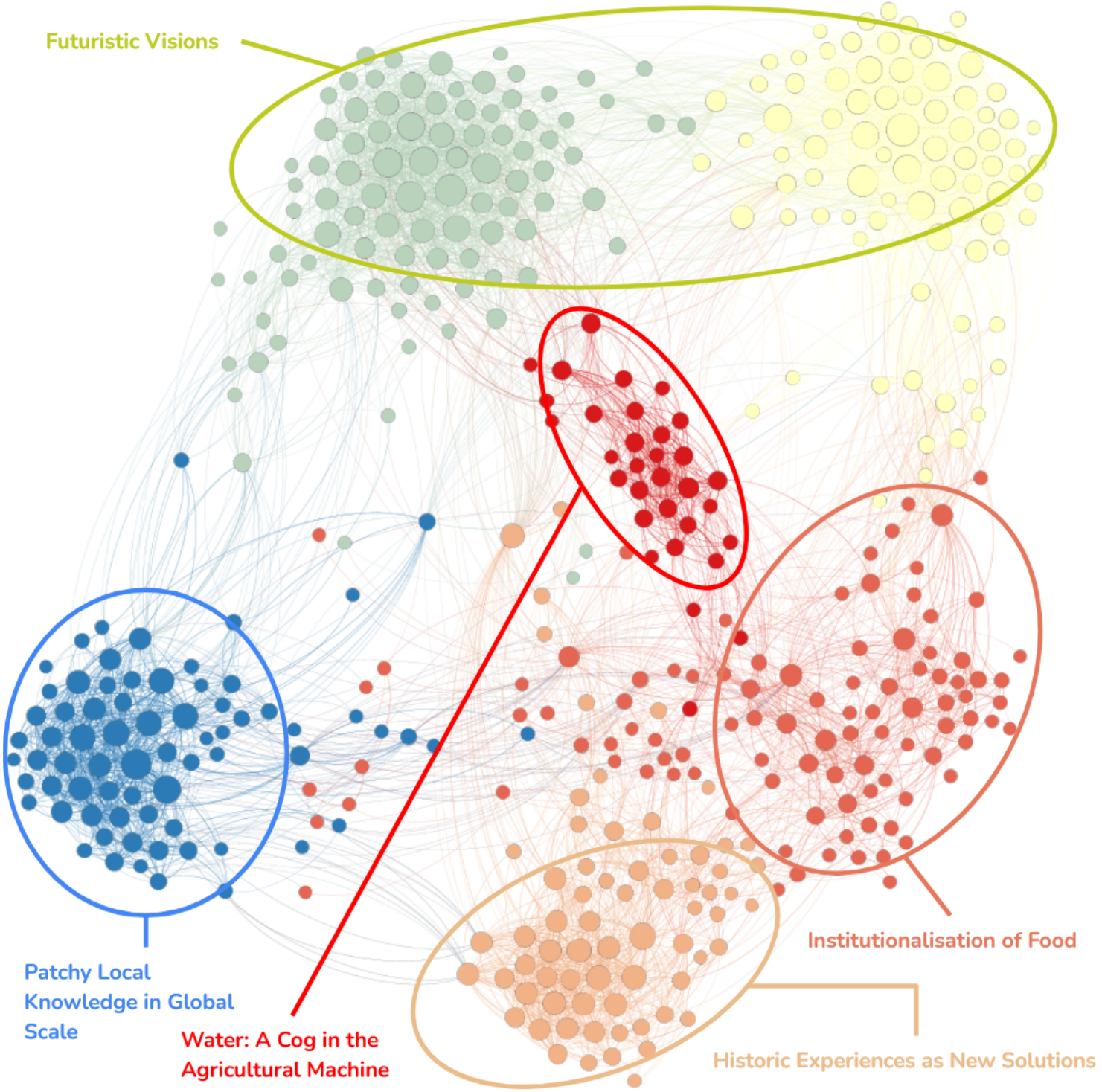

Figure 3: Multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus.

2.2 Institutionalisation of Food

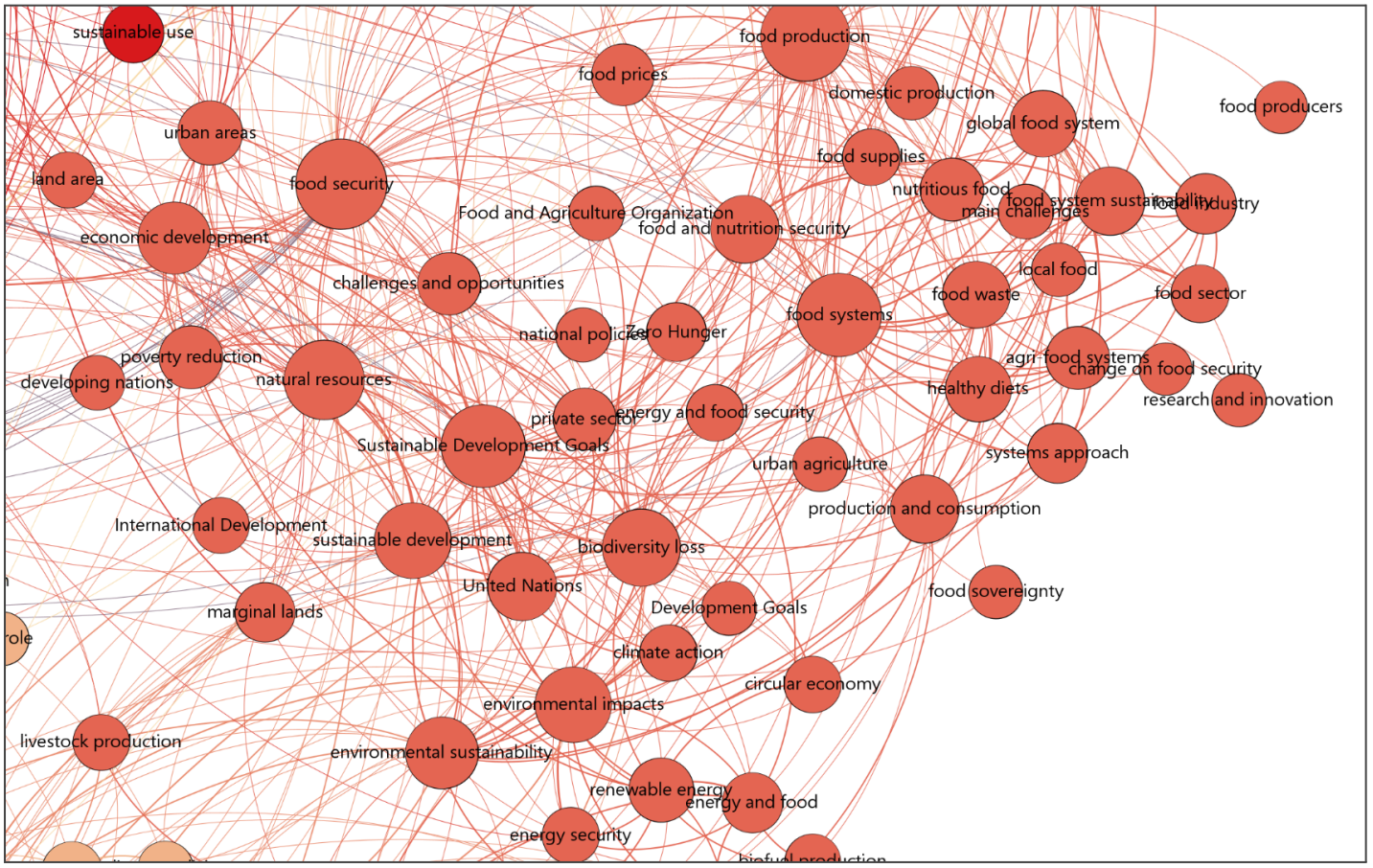

Figure 4: A close up of the cluster 'Institutionalisation of Food' from the multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus

While exploring the dark orange cluster, it quickly becomes apparent that it is predominantly concerned with the institutionalised aspect of food (in)security. The node 'Sustainable Development Goals' sits in the centre of the cluster surrounded by, and connected to, smaller nodes such as 'the United Nations', 'Food and Agriculture Organization', 'economic development', 'natural resources', 'poverty reduction', 'developing nations', and 'private sector'. This aligns well with the points iterated in section 1.2.2 The United Nations, positioning the UN and FAO as main actors in facing the challenge of food (in)security with the goal to secure healthy, plenty, and nutritious food to all, particularly the most vulnerable in developing nations.

It also reflects what the predominant focus areas are from an institutionalised perspective and underlines how complex and multifaceted the debate is. For example, the central nodes 'economic development' and 'poverty reduction' reflect that economic development and

reduction of poverty is incremental when addressing food insecurity. At the same time, as mentioned in 1.2.2.1 Food & Agriculture Organisation, one of the key focus areas in facing food insecurity within the UN and FAO is building robust and resilient food systems. The node 'food systems' is closely connected to 'food production', 'food system sustainability', 'global food system', 'food industry' and 'food and nutrition security'.

Interestingly, the node 'climate change' also resides in the dark orange cluster and is closely intertwined with the aforementioned nodes. This emphasises that climate change has a great influence on food (in)security and the discourse surrounding it, and due to the fact that it is closely connected to the 'United Nations' and 'FAO' nodes as well, this might indicate that it is a key focus point in said institutions. The impact of climate change on food security is further underlined by Arivelarasan et. al (2023) who, in their study, writes that many developing countries heavily rely on rice and wheat as a source of food. However, due to climate change, these crops are in severe danger in the coming years. They state that "Our results showed that the future rice productivity of the Cauvery delta region would be reduced by 35% between 2021 and 2040 and by 16% between 2041 and 2050" (Arivelarasan et al., 2023, p. 1). Meaning, rice production in peninsular India, a major rice-growing hotspot, is expected to face a great challenge in terms of food security. As problematic as that may be, it not only affects that region but also many neighbouring regions as they rely on food imports from the Cauvery delta region (Arivelarasan et al., 2023). This particular component of trade is also reflected in the topics within the dark orange cluster where nodes such as 'food import' and 'food prices' are connected to 'food systems'.

Additionally, the nodes 'Future Food' and 'Global population' reside in the dark orange cluster and function as a sort of bridge to the yellow cluster. This provides an interesting perspective to the aspect of institutionalised food because the yellow cluster is predominantly concerned with the future perspective, and new and modern technologies with nodes such as 'population increase', 'artificial intelligence', and 'genome editing'. For example, in an article, by Godfray and Garnett (2014) that states the challenges regarding food security include "a growing and demographically changing population; average increases in purchasing power and expectations and consequent diet change; resource scarcity; global environmental change (including the climate), and finally the need to mitigate greenhouse gas emissions while simultaneously adapting to its consequences." (Godfray & Garnett, 2014, p.

2). Hence, the issue of food security touches upon a multitude of facets. To address this dichotomy of producing more food while also being conscious of the environmental impacts - and how it is all intertwined, they propose "sustainable intensification" (SI) (Godfray & Garnett, 2014) as a means to approach this complex affair. Admittedly, they note that this is not a simple or easy approach, but rather a necessary one. To do this, innovation of past, present, and future food systems and technologies has to happen, particularly on a policy and legislation level, which could be the explanation as to why the node 'future foods' exists in the institutionalised dark orange cluster. Diving deeper into the innovation of future foods, food systems, and SI, additional literature argues that innovating food systems to a more plant-centric one as opposed to relying on meat will be of major value in terms of feeding a growing population sustainably (Mendoza, 2023). Shang et al. (2019) writes that innovation and applications of new technologies such as nano-engineering "is a handy tool for boosting crop production and assuring sustainability. Nanotechnology helps to improve agricultural production by increasing the efficiency of inputs and minimizing relevant losses." (Shang et al., 2019, p. 1). And Talaviya et al. (2020) writes that technologies such as artificial intelligence could be the answer in addressing the challenge of food security because "This technology has protected the crop yield from various factors like the climate changes, population growth, employment issues and the food security problems" (Talaviya et al., 2020, p. 1).

Ultimately, the nodes residing in the dark orange cluster reflects the very complex and multifaceted nature of the topic in the context of the institutionalised arena. From nodes such as 'climate change' to 'future foods', it inspired a more in-depth review of literature regarding climate change's impacts on food systems as well as the prospects and innovation of new food technologies to address the challenge of food (in)security in the institutionalised domain. Thus, the following presentation of the remaining clusters will include a focus on their connections to the dark orange cluster.

2.3 Historic Experiences as New Solutions

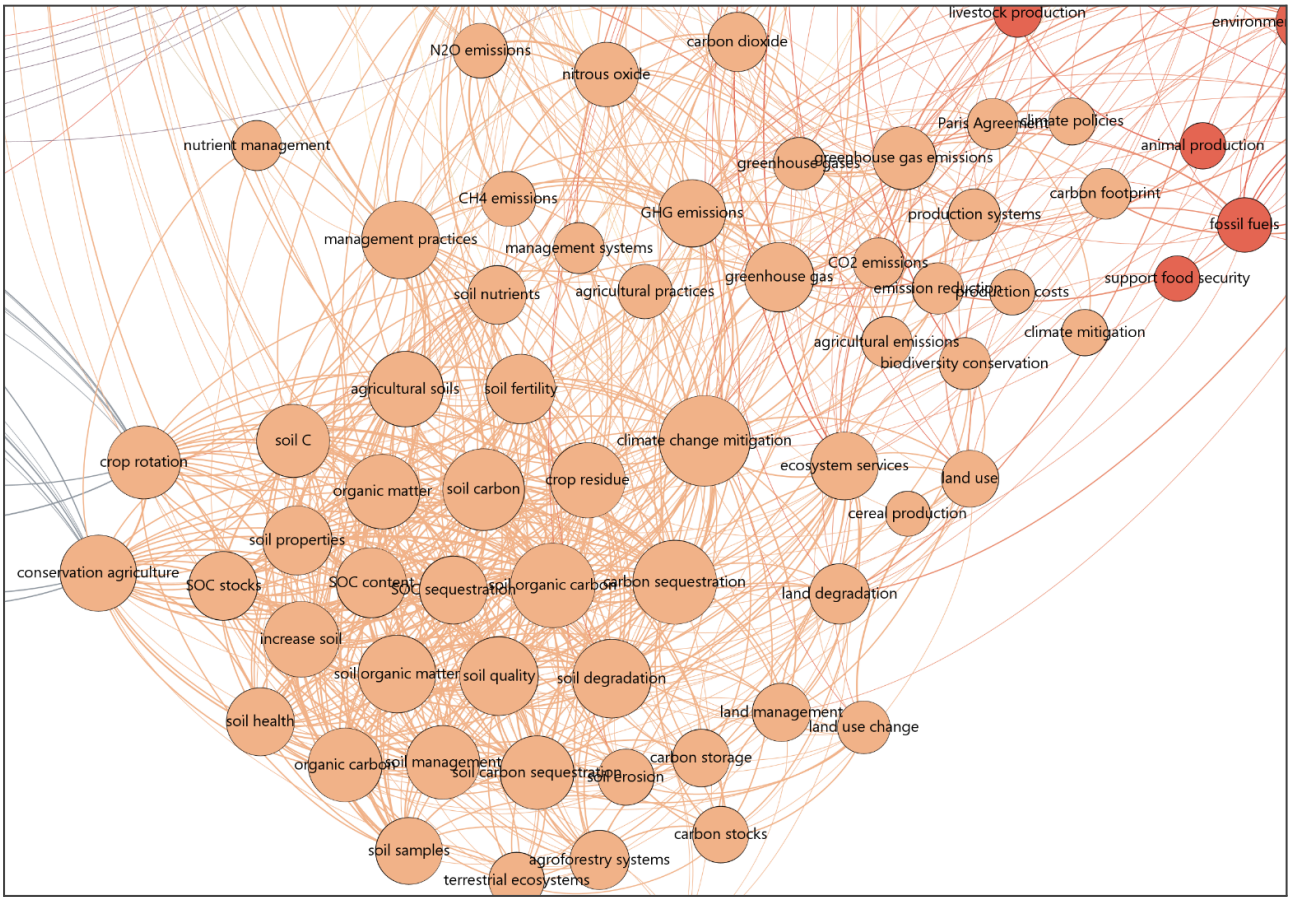

Figure 5: A close up of the cluster Historic Experiences as New Solutions from the multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus

Shifting our gaze to the light orange cluster, the overarching topic here is that of the impact of the human tradition and practice of agriculture on soil fertility and quality. This includes nodes regarding different agricultural practices, such as crop rotations and agroforestry systems. The topics of nodes are somewhat split in two without any visual gap on the map, the nodes to the left are very much related to agricultural practices, whereas the nodes to the right in the cluster are more concerned with greenhouse gas (GHG) emissions. And as one moves closer towards the dark orange cluster, nodes such as 'climate policy' and 'the Paris Agreement' appear; nodes that are related to institutionalisation.

When shifting focus to the nodes on the left of the cluster, one encounters the history of the relationship between human and agriculture, which is an old one, and so is the story of agroforestry dating back to Roman times. Agroforestry refers to the "cultivation and use of

trees and shrubs with crops and livestock in agricultural systems", with the aim of creating "(...) a more ecologically diverse and socially productive output from the land than is possible through conventional agriculture" (Gold, 2016), and to decrease and limit the human impact on land, thus an understanding agriculture, as a technology/phenomenon that is deployed in multifunctioning landscapes (Godfray & Garnett, 2014). Such multifunctioning landscapes can be achieved through different agricultural and soil/land management styles, such as biodiversity-based production systems which includes agroecological farming and forest management (Kremen & Merenlender, 2018). The notion of multifunctioning working landscapes is based on the understanding of importance of biodiversity, both in regards to mitigate the consequences of climate change and how it it can increase and create sustainable nature systems that are more resilient to change; these different types of management styles to maintain ecological diversity is based on principles practices since ancient times (Kremen & Merenlender, 2018).

When turning the eye back to the right side of the cluster we find the nodes of 'climate policy' and 'the Paris Agreement', as previously mentioned, and nodes related to carbon and GHG emissions in agriculture. Thus, an explanation to why the node of 'the Paris Agreement' is to be found in this cluster instead of the dark orange cluster, could lie in the focus on the reduction of GHG emissions of the Paris Agreement, compared to the more general institutionalised broad focus of the SDGs, which is a node found in the dark orange cluster. The focus on GHG emissions within this cluster, then ties both sides of the cluster together through nodes such as 'carbon sequestration' that refers to the process of "transferring atmospheric CO_2 into long-lived pools and storing it securely so it is not immediately reemitted" (Lal et al., 2007, p. 1623), strategies to increase and create these pools is related to i.e. soil restoration, woodland regeneration, water conservation and agroforestry practices (Lal, 2004; Lal et al., 2007); this process is also indirectly mentioned in the Paris Agreement through a focus on sustainable forest management to improve forest carbon stock (United Nations, 2015a).

Overall the light-orange cluster has a backwards outlook to finding and proposing solutions and changes to the agricultural practices, compared to the future oriented cluster described in the following section.

2.4 Futuristic Visions

The following section includes the examinations of two clusters simultaneously as they were found to have an overarching shared theme concerning futuristic vision. However upon further exploration, their distinctions became apparent which will be shortly illustrated in the sections below.

If we then begin with the yellow cluster in our visualisation, the one we have dubbed Future Visions of Agriculture, nodes such as ‘Anthropogenic activities’, ‘artificial intelligence’ and ‘genome editing’ appear. Anthropogenic activities is a collective term for all the uniquely human activities that alter or lessen the natural world around us. One sizable anthropogenic activity being agriculture (Jha, 2010).

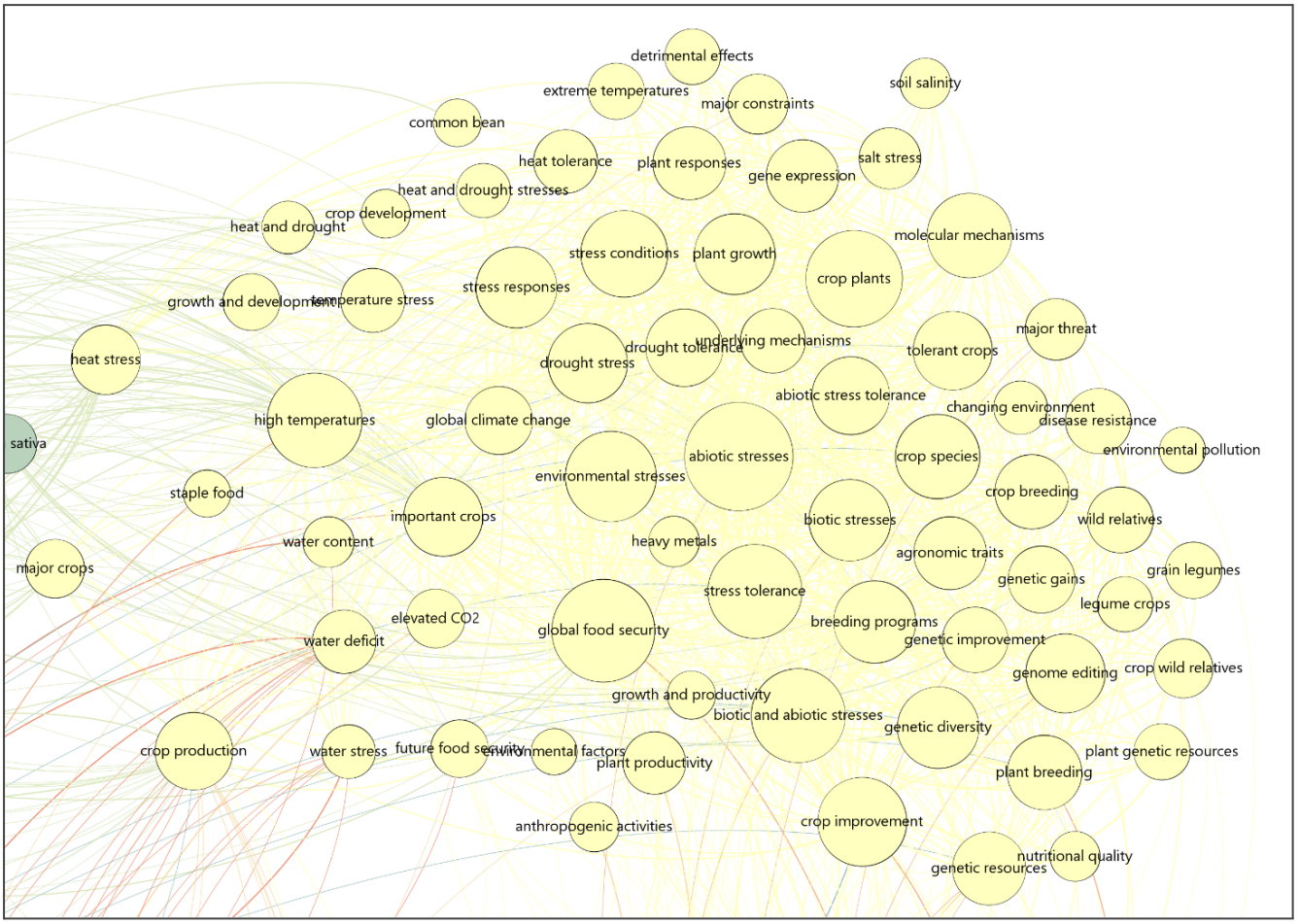

Figure 6: A close up of the cluster Future Visions of Agriculture from the multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus

Genome editing is a practice that we humans have been doing since we put down our hunting spears and started farming, for approximately 10.000 years or so. Now we can alter or remove the DNA within the genome of an organism, instead of cross-pollinating for years. In our cluster genome editing is connected to terms such as disease resistance and agronomic traits, as well as other terms starting with genes, genetic improvement, genetic diversity, but genome editing and genetically modified organisms (GMO) are a topic in and of itself which won't be covered in great detail in this paper. The last larger topic found within the yellow cluster is Extreme Temperatures, being a central one that bridges the connections between many of the topics mentioned above. It has connections to 'water deficit', drought stress', 'heat tolerance' and 'global climate change'. These concerns have led to a need for our crops to change at the same pace as our weather, which leads to GMO crops. Climate change drastically changes the weather and soil conditions for farmers globally. So perhaps in order to sustain ourselves we must pursue new ways to produce food (Bita & Gerats, 2013). We find that the yellow cluster connects with the nodes 'global population', 'food production' and 'development goals' in the dark orange cluster that our research has been focused on, tieing the concerns above in with the institutionalised perspective in the dark orange cluster.

Moving on to the green cluster, which we have dubbed Agricultural Divinations, the largest nodes are 'representative concentration pathways' (RCP), 'crop models' and 'future climate change'. All of these nodes point forwards to the future and to the impacts of climate change on our crops. RCPs are a set of four pathways used in predictive climate modelling that are used by the intergovernmental panel on climate change (IPCC) which is a division of the UN. The RCPs span to the year 2100 and are a useful tool for both emission mitigation and impact analysis of climate change. Crop models are a way to present quantitative data about how a crop grows in relation to its environment, using weather data, including solar radiation, temperatures and rainfall as well as data concerning the soil. A crop model can simulate crop growth, nutrient uptake and yield. These crop models serve many purposes in agriculture, but one of them is similar to the RCPs mentioned above, to predict the impacts of climate change (Wiebe et al., 2015). There are few connections between the green and dark orange clusters, which seems odd, given that IPPC and UN in general give much credence to predictive models like RCP's. But climate and global temperature; two nodes found in the dark orange cluster, do connect the two clusters.

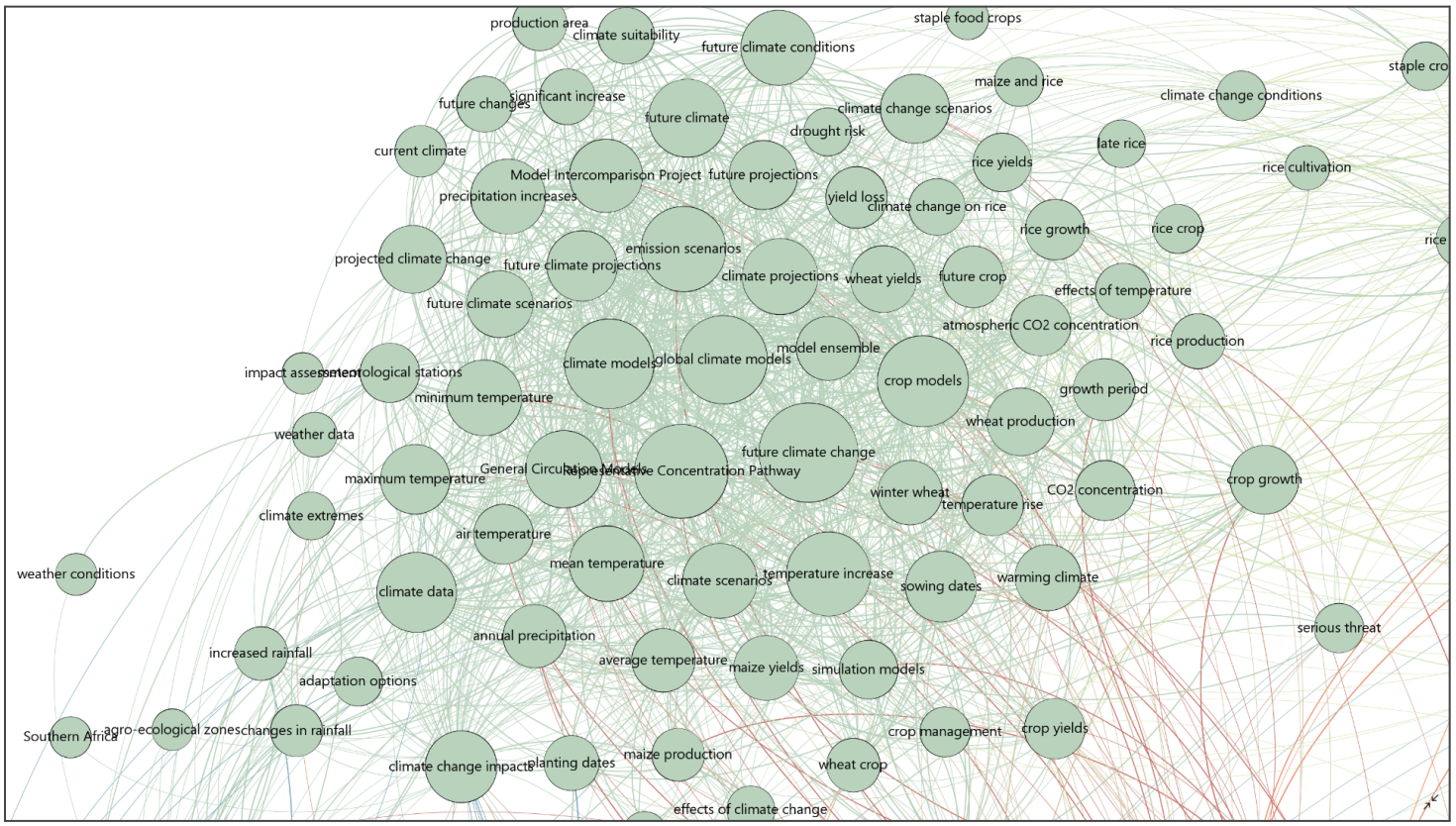

Figure 7: A close up of the cluster Agricultural Divinations from the multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus

Spread out in the cluster we also find three of the most common crops globally. Maize, rice and wheat, as well as many terms revolving around crops, temperatures, drought, data and prediction models. When all of this is put together it can be summarised as the impact of future climate on crops. Whereas the yellow cluster was concerned more with mitigation of climate change and adaptation of crops, the green is concerned with the impact or consequence of climate change and how this will impact our crops and through that food security.

2.5 Water: A Cog in the Agricultural Machine

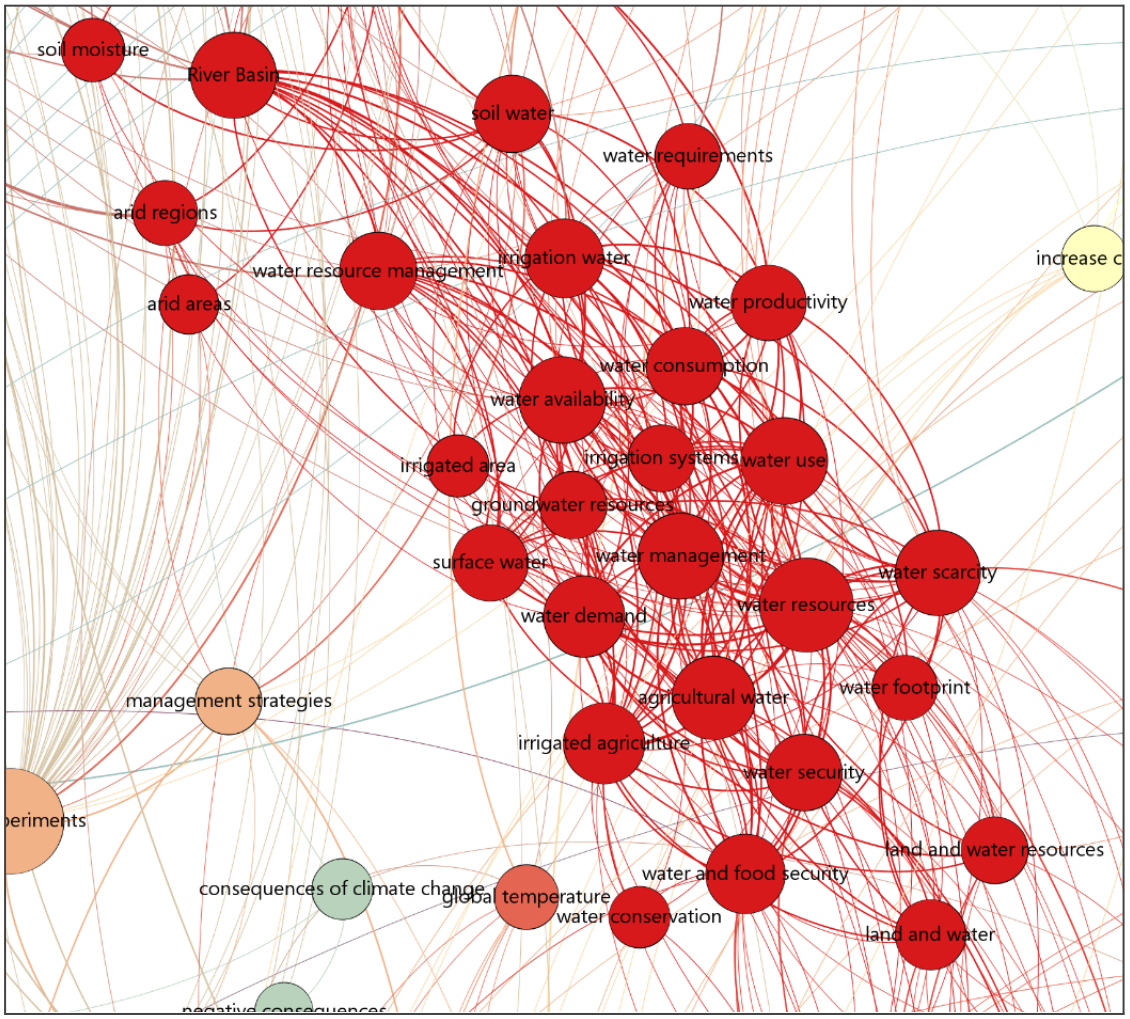

Figure 8: A close up of the cluster Water: A Cog in the Agricultural Machine from the multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus

"Life as we know it could not have evolved without water and dies without it" (Chaplin, 2001, p. 54), all organisms consists of cells, from the largest animals to the smallest microbes and everything in between, and the functioning of cells rely upon water to create energy to exist and grow. Thus human agricultural practices highly rely on water, in regards to the consistency of access and the quality of it. When shifting the focus to the red cluster, we find ourselves surrounded by water and its role within food production. The placement of the water cluster in the centre of the network, fits metaphorically well with the fact that water serves the incremental role for and within all life on Earth, including being a part of the foundation for agriculture to even exist - water, a cog in the agricultural machine. The red cluster is tied well into the dark orange cluster through the nodes that imply water as a

resource, the scarcity of that resource - these resource related nodes are connected to the nodes of the dark orange cluster that are concerned with a growing population (which increases the need for irrigation water and drinking water, to provide food and water security), and sustainable development and the SDG. When applying the understanding of water as a resource, one can measure its usage using 'the footprint' metaphor which is also applied to carbon, its monetary value, and last but not least as a resource that can be used/abused/misused, and even politicised by different social interests (Latour, 1993).

As any other aspect of the world, water and its usages are challenged and/or changed in the epoch of the anthropocene due to climate change. Increasing climate extremes such as droughts and floods affects the "variability in precipitation, soil moisture and surface water" (Taylor et al., 2013, p. 322) and deterioration of freshwater ecosystems (Hanjra & Qureshi, 2010). This causes further problems for agricultural practices that rely on irrigation for crop production or water for livestock production, and thus have a great impact on food security. The water crisis is seen as "the major constraint to increased food production over the next few decades" (Hanjra & Qureshi, 2010, p. 366), as opposed to the lack of arable/productive lands. As many other of the world's resources, water suitable for irrigation use is unevenly distributed, further skewed by droughts and flooding. Through the current water usage, irrigation in agriculture being the largest user of water, we face the threat of water scarcity/water insecurity sooner rather than later (Hanjra & Qureshi, 2010).

2.6 Patchy Local Knowledge in Global Scale

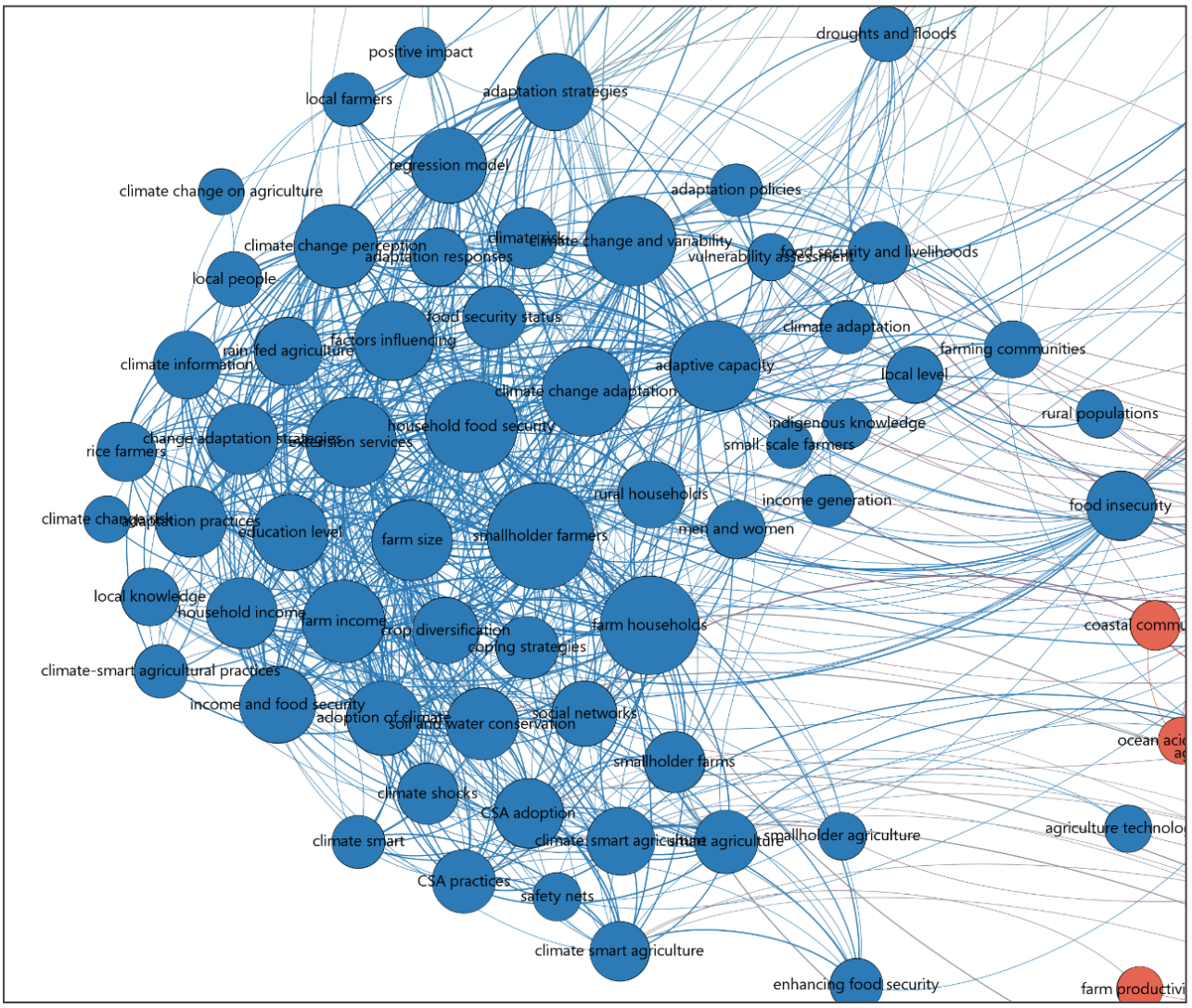

Figure 9: A close up of the cluster Patchy Local Knowledge in Global Scale from the multi-terms co-occurrence network of academic literature regarding food (in)security and climate change from Scopus

The blue cluster offers an anthropocentric perspective on climate change with a particular focus on its impact on smallholder agriculture. This is reflected by central nodes such as ‘local knowledge’, ‘climate smart agriculture’ (CSA), and ‘climate adaptation’.

Local knowledge refers to the knowledge and practices that farmers and communities have developed over time through their interactions with the local environment. This knowledge is often context-specific and is based on the experiences of the community with the local climate and soil conditions. Integrating local knowledge into CSA strategies can help farmers to adapt

to changing climate conditions by using traditional techniques that have proven effective in the past. FAO describes CSA as:

> (...) an approach that helps guide actions to transform agri-food systems towards green and climate resilient practices. CSA supports reaching internationally agreed goals such as the SDGs and the Paris Agreement. It aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible (FAO, n.d.-b).

In their work, Chaudhury et al. (2013) suggests that one way to integrate local knowledge into the process of ensuring resilience to agriculture is through the introduction of participatory scenarios. These participatory scenarios, based on involvement and engagement of stakeholders in the development of possible future scenarios, can help policymakers better understand the potential impacts of climate change on food security and identify effective adaptation strategies (Chaudhury et al., 2013). Further, they provide insight into the potentials of participatory scenarios as a tool to link science and policy on food security under climate change in East Africa, and highlights the importance of collaborative and multidisciplinary approaches to addressing this complex issue (Chaudhury et al., 2013). In relation to the dark orange cluster dealing with the institutionalisation of food, it can be observed that the main node connecting the two clusters is the blue node labelled “rural areas”. This suggests that from an institutionalised perspective, rural areas are of focus and part of the debate surrounding food (in)security.

This interaction between the institutionalised cluster, rural areas, and their ability to adapt to climate change, are further underlined by Di Falco et al. (2011) in their work surrounding climate adaptation based on data from a household survey conducted in Ethiopia. Climate adaptation refers to the actions that people take to cope with the impacts of climate change (Di Falco et al., 2011). In the context of agriculture, climate adaptation can involve changes in farming practices, such as shifting to crops that are better adapted to changing climate conditions, using irrigation to cope with drought, and changing planting times to avoid extreme weather events. Di Falco et al. (2011) found that adaptation measures such as improved irrigation systems, drought-resistant crops, and livestock management practices could help households cope with the impacts of climate change. However, they may not be

sufficient to ensure food security for all. Factors such as poverty, access to markets, and other socio-economic factors also play a significant role in determining food security outcomes. These topics are reflected in the dark orange cluster as nodes such as 'poverty reduction' and 'economic development'. Interestingly, while the node 'food security' exists in the dark orange cluster, the node 'food insecurity' exists in the blue cluster. This could indicate that within the institutionalised debate on food there is a stronger concern to ensure and improve food security, while the debate surrounding smallholder agriculture and rural areas is more concerned with providing food for the people, while living in food insecurity.

2.7 Conclusion

Throughout the literature review it became evident that the topic of food (in)security and its suggested solutions are somewhat bound in time, they are temporal. The debate in itself is extremely intertwined and multifaceted, ranging from extracting lessons from historical agricultural practices, GMO, AI, institutionalisation, and small local livelihood farmers. Yet all topics and areas of the debate are somewhat connected to climate change, underlining how influential the changes in weather and climate are in regard to food (in)security, and on possible solutions to feeding the growing human population of the world. As mentioned in section 1.2 Context, the institutions, UN and FAO, working to improve food security are faced with a plethora of factors influencing the problem in front of them, both human created factors such as the food systems, and non-human factors i.e. extreme weather. Overall, the network shows a multitude of technologies, imagined solutions and/or imagined part of the solution(s), and almost all of them are to some degree connected to the cluster *Institutionalisation of Food*. Thus, the next section of the thesis will present, among other theory, the theoretical framework of the *anthropocene*, due to the heavy influence of climate change on the topic of food (in)security as well as *sociotechnical imaginaries* because of the plethora of different technologies in the context of a better future that is at play in the network and especially in the institutionalised cluster.

3.0 Theoretical Framework

The following section has been divided into five subsections, each tasked with introducing and elaborating upon the theoretical framework for this master thesis. Starting with an introduction of Sheila Jasanoff's term *sociotechnical imaginaries* and her notion of *civic epistemologies*, followed by an elaboration of *the anthropocene* and Anna Tsing's concept of *patchy anthropocene*. Concluding with a presentation of Donna Haraway's concept of *situated knowledge*.

3.1 Sociotechnical Imaginaries

Jasanoff (2015) defines *sociotechnical imaginaries* as:

> "(...)"collectively held and performed visions of desirable futures" (or of resistance against the undesirable), and they are also "animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology." Unlike mere ideas and fashions, sociotechnical imaginaries are collective, durable, capable of being performed; yet they are also temporally situated and culturally particular. Moreover, as captured by the adjective "sociotechnical," these imaginaries are at once products of and instruments of the coproduction of science, technology, and society in modernity" (Jasanoff & Kim, 2015, p. 19).

Yet before venturing deeper into the dreamscapes of *sociotechnical imaginaries*, we turn to the roots and foundation of Jasanoff's concept of STI. Being deeply rooted in both the world of science, technology and society studies (STS) and studies of public policies, one starts with a focus on the creation of Actor-Network Theory (ANT), and how it has helped create a foundation for STI.

The creation of the ANT framework came out of necessity; to create an analytical tool without preconceived boundaries of the elements that creates, stabilises and enact the social systems, thus a need/want to bring the focus on human-non-human interaction and relations back into classic sociology. Michel Callon and Latour thus proposed, through the perspective of ANT, that all social systems "... are seen as hybrids composed of heterogeneous elements: people, objects, nonhuman-entities, organizations, and texts are takes as interactive participants in the networks that make up the structures of modernity" (Jasanoff & Kim, 2015, p. 15). Thus,

within the field of STS, ANT laid the foundation for inquiry into "the connections between humans and the animate and inanimate features of the environments they make an inhabit" (Jasanoff & Kim, 2015, p. 15), thus enabling one to examine the *sociotechnical* and its nature (Jasanoff & Kim, 2015, pp. 15–19). To mediate the humanistic bias within classical sociology and to create a tool that could help dissolve the rigid binaries of previous frameworks for understanding world creating; Latour and Callon introduced the notion of actants within ANT, referring to the non-humans that play an active role to create, mediate and stabilise the network in question (Jasanoff & Kim, 2015, p. 16). A general critique of ANT, one that Jasanoff shares and thus have tried to mitigate within the framework of STI, is the flatness of networks resulting in a presentation of power and agency that seems equally distributed, "(...) making all actions and agents seem equally empowered, or disempowered, and therefore equally responsible, or irresponsible (...)" (Jasanoff & Kim, 2015, p. 16). Yet ANT and other frameworks within the tradition of STS, helped create a pathway where it is possible to investigate "(...) more forms of agency, more pathways of change, and more narratives of causation (...)" (Jasanoff & Kim, 2015, p. 16), which supports Jasanoff's aim of disrupting the flatness of traditional ANT, and thus trying to give room to the topographies of power that makes up the landscape of the specific network surrounding the STI in question. Jasanoff problematizes the equivalence between non-human and human actors/actants that the hybridity of ANT is at risk of establishing; the non-human actants can be given a voice by scholars and writers, an action of rebellion within the area of interspecies ethnography, also known as the transhuman and posthuman. Therefore, Jasanoff turns her eyes to the notion of imagination, because "(...) it is still humans and their collectives who can imagine a world (...)"(Jasanoff & Kim, 2015, p. 17). Jasanoff argues that power and action are inherent traits of the imagination, which in itself is a trait of humans, and thus the institutions they create. But the skill of imagining a better world or a better tomorrow, have no real impact on its own, it "(...) requires putting in play the intricate networks (...)"(Jasanoff & Kim, 2015, p. 17), that makes up the hybrid heterogeneous structures that create the world.

When turning to one of the other pillars holding up the foundation for STI, one sees the notions of *master narrative* and *discourse* from the realm; studies of policy. *Master narrative* refers to the framework of creating an understanding of "(...) a rationale for a society's long evolutionary course while also committing that society to keep performing the imagined lines of the story." (Jasanoff & Kim, 2015, p. 20). STI differs from the *master narrative* framework

in allowing a plethora of different imaginaries being in play at the same time, though this was not the case in this thesis, whereas a master narrative implies a monolithic vision, with less to no room for changes in the narrative. A master narrative being a firm and confined "(...) singular retelling of national and cultural history (...)" (Jasanoff & Kim, 2015, p. 20) albeit STI anchors itself in the temporally situated and culturally particular, and within the realm of allowing changes to the imagined, giving more room to advances in and invention of new sciences and technologies that could have an effect on the different forms of social life and order (Jasanoff & Kim, 2015, p. 19). When shifting the focus onto one of the other inspirations of STI, one is faced with discourses. Within the field of discourse, it shares the properties of being collective and systemic with imaginaries, yet traditionally discourse mainly focuses on language and is thus more loosely or "(...) less directly associated with action and performance or with materialization through technology" (Jasanoff & Kim, 2015, p. 20).

With the foundation of STI clear in our minds, we turn back to what Jasanoff and her notion of STI provides in the traditions of STS and political theory, and how STI can contribute to overcome some of the limitations of earlier work within the two aforementioned traditions. Jasanoff suggests four different ways in which STI could help overcome the aforementioned limitations, only three will be explained in the following subsections.

First, STI creates a framework which can help provide answers to questions regarding differences, "(...) in particular the unexpected divergence of sociotechnical outcomes across political regimes (...)" (Jasanoff & Kim, 2015, p. 21), differences existing across different political regimes that share fundamental commitments and aspirations. Traditional arguments from political science; that extrinsic events forms the momentum behind political agendas, henceforth "(...) after momentous happenings convergence rather than divergence ought to be the rule" (Jasanoff & Kim, 2015, p. 21), yet Jasanoff opposes that line of argument, stating that: "(...) globally homogeneous meaning making and policy formulation" (Jasanoff & Kim, 2015, p. 21) is being prevented and/or hindered by the absorption, inclusion and integration of the discrepancies, within the responses to the emergence of new technology and technological disasters, into the pre-existing imaginaries.

Secondly, Jasanoff argues that *sociotechnical imaginaries* offers the possibility to engage directly with human hope and desire for the future and how these are directly or indirectly

combined with and formed by past achievements, material infrastructures "(...) or the normative infrastructures of constitutional principles, juridical practices, and public reason" (Jasanoff & Kim, 2015, p. 22) and vice versa. Within this understanding and perspective, technological systems serve with a double function, "pointing back at past cultural achievements and ahead to promising and attainable futures, or to futures to be shunned or avoided" (Jasanoff & Kim, 2015, p. 22). In other words, the application of *sociotechnical imaginaries* can provide answers to questions regarding time and change, and how human expectations to the future remain stable enough over time to be defined as eras. Jasanoff finds an explanation in relative embedding, or rootedness, to understand the durability and change of imaginaries; that the materiality of technoscience is "(...) implicated in the stability and instability of social arrangements, but just as important are the beliefs systems out of which those materialities emerge and which give them value and meaning" (Jasanoff & Kim, 2015, p. 22).

With the use of the term *extension*, that refers to "views and practices originating with individuals or small groups acquire governing force across much wider domains, both physical and temporal" (Jasanoff & Kim, 2015, p. 22), STI offers the understanding that "space and social order are coproduced in part through the spread of ideas and practices - and indeed ideologies - across times and territories" (Jasanoff & Kim, 2015, p. 22). Moreover, STI offers a more symmetrical approach to inquiries into the topographies of power and morality, and how these concepts are intertwined with the force of technology and science. Within this third area of arguments, Jasanoff states that "(...) the concept [STI] allows for spatial imaginations to preexist and channel the spread of science and technology, instead of only vice versa" (Jasanoff & Kim, 2015, p. 22). As previously mentioned the theoretical framework of STI allows for a plethora of imaginaries to be in play and in competition with each other at any given time, or in other words, the framework supports a competition between different visions of possible futures. By allowing this competition STI, as a theoretical framework, argues that it "(...) restores some of the indeterminacy of history and avoids the determinism built into grand narratives of scientific progress (...)" (Jasanoff & Kim, 2015, p. 23).

Differences and discrepancies, human hope and desires for futures, extension across spaces, and collective formations and individual identity, areas of possible contributions of STI based new insights. Overall the framework creates room for the investigations into the visions of

desirable futures, within the tradition of STS, through the *sociotechnical imaginaries* defined as:

> "(...)"collectively held and performed visions of desirable futures" (or of resistance against the undesirable), and they are also "animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology." Unlike mere ideas and fashions, sociotechnical imaginaries are collective, durable, capable of being performed; yet they are also temporally situated and culturally particular. Moreover, as captured by the adjective "sociotechnical," these imaginaries are at once products of and instruments of the coproduction of science, technology, and society in modernity" (Jasanoff & Kim, 2015, p. 19).

The above definition, the other concepts and dimensions of STI elaborated upon in the sections above will be utilised to explore the imaginaries on a supranational global level, within the UN's subagency FAO. STIs are created, held and negotiated over time, and thus this thesis has a historical research approach, including all the reports FAO have published since they were created in 1945. By"(...) following ideas through time (...) one gains a feel for what is fixed and what is changeable in social self-understandings as well as the reasons why" (Jasanoff & Kim, 2015, p. 335). The notion of imaginaries being able to spread across cultures, time, and space can be helped along by international or supranational organisations, due to them being "(...) prominently involved in creating, institutionalizing, and extending sociotechnical imaginaries". (Jasanoff & Kim, 2015, p. 335)

3.1.1 Civic Epistemologies

Sheila Jasanoff's concept of *civic epistemology* is an important framework for understanding the role of knowledge and expertise in democratic societies. In her book *Designs on Nature: Science and Democracy in Europe and the United State*s (2005), Jasanoff offers a detailed analysis of the relationship between science, technology, and democracy, and how this relationship is shaped by social and political factors.

> "Public reasoning then achieves its standing by meeting entrenched cultural expectations about how knowledge should be made authoritative. Science, no less than politics, must conform to these established ways of public knowing in order to gain broad-based support - especially when science helps underwrite significant collective choices. I use the term

> civic epistemology to refer to these culturally specific, historically and politically grounded, public knowledge-ways" (Jasanoff, 2005, p. 249).

One of the key arguments in Jasanoff's book is that science and technology are not neutral or objective fields of knowledge. Rather, they are shaped by a range of social and political factors, including economic interests, cultural values, and power relations. Therefore, the production and use of scientific and technical knowledge must be subject to public scrutiny and debate, in order to ensure that it is aligned with democratic values and goals (Jasanoff, 2005, pp. 264–267). Jasanoff's concept of *civic epistemology* offers a framework for interrogating the values, assumptions, and practices that are the foundations of scientific and technological knowledge production and use. It involves examining the ways in which scientific and technical knowledge is shaped by social and political factors, and how this knowledge, in turn, shapes social and political life. By recognizing the complex and dynamic nature of knowledge production and use, *civic epistemology* offers a more democratic and participatory approach to governance (Jasanoff, 2005, p. 271).

Another one of the key components of *civic epistemology* is the recognition that scientific and technical knowledge is not the only form of knowledge that is relevant to decision-making. In a democratic society, decision-making should be informed by a range of knowledge and expertise, including experiential, practical, and local knowledge. Therefore, *civic epistemology* involves developing mechanisms for incorporating diverse forms of knowledge and expertise into decision-making processes (Jasanoff, 2005, pp. 254–255). Jasanoff argues that this requires a rethinking of the epistemological foundations of science and technology, and the development of new modes of governance that are more inclusive and participatory. She suggests that this can be achieved through a range of mechanisms, including citizen participation in science and technology policy-making, the creation of new forms of expertise that are more responsive to social and political needs, and the establishment of new forms of accountability that enable citizens to hold decision-makers accountable for their actions (Jasanoff, 2005, pp. 261–262). Overall, Jasanoff's concept of *civic epistemology* offers an important framework for understanding the complex relationship between science, technology, and democracy. By recognizing the ways in which knowledge is shaped by social and political factors, and the importance of diverse forms of knowledge and expertise in

decision-making, *civic epistemology* offers a more democratic and participatory approach to governance.

In general *civic epistemologies* are concerned with the production, sharing, and utilisation of knowledge to address social issues and foster positive change within communities (Jasanoff, 2005). Rooted in local knowledge and experiences, *civic epistemologies* emphasise participatory and collaborative processes that empower individuals and communities. They challenge traditional hierarchies of expertise by valuing diverse perspectives and forms of knowledge. *Civic epistemologies* seek to democratise knowledge production by involving stakeholders in decision-making, fostering collective agency, and promoting social justice. For instance, participatory action research initiatives, community-led knowledge-sharing platforms, and citizen science projects are all manifestations of *civic epistemologies* in action (Jasanoff, 2005).

3.1.2 Imaginaries & Civic Epistemology

Despite the conceptual differences between *civic epistemologies* and *sociotechnical imaginaries,* they share some commonalities. Both concepts highlight the social construction of knowledge and technology, emphasising the need to consider societal values, power dynamics, and cultural contexts in their formation (Jasanoff, 2005; Jasanoff & Kim, 2015). They challenge the notion of a single, authoritative source of knowledge or a predetermined trajectory of technological development. Both *civic epistemologies* and *sociotechnical imaginaries* recognize the importance of including diverse perspectives and engaging stakeholders in shaping knowledge and technology processes. Moreover, they share an underlying ethos of empowering communities and fostering more inclusive and democratic approaches to knowledge and technology (Jasanoff, 2005; Jasanoff & Kim, 2015).

While *civic epistemologies* and *sociotechnical imaginaries* converge on certain aspects, they also diverge in significant ways. *Civic epistemologies* focus primarily on the production, sharing, and use of knowledge, centering on local and community contexts. They prioritise participation, collaboration, and the democratisation of knowledge (Jasanoff, 2005). In contrast, *sociotechnical imaginaries* revolve around the collective visions and assumptions that shape the relationship between technology and society. They transcend specific contexts, encompassing broader narratives and shared understandings about the interplay of technology

and social structures. *Sociotechnical imaginaries* are influenced by a range of actors, including experts, policymakers, and societal norms (Jasanoff, 2005; Jasanoff & Kim, 2015).

In conclusion, *civic epistemologies* and *sociotechnical imaginaries* provide complementary lenses through which to understand the interplay of knowledge, technology, and society. While *civic epistemologies* emphasise participatory knowledge production and local contexts, *sociotechnical imaginarie*s focus on collective visions and assumptions about technology's role in society. Recognizing their similarities and differences is crucial for developing inclusive and ethically grounded approaches to knowledge creation, technology design, and societal change. By integrating these concepts, we can foster more democratic, equitable, and responsive frameworks for engaging with knowledge according to Jasanoff. Within this thesis the application of *civic epistemologies* will be utilised to highlight how FAO either tries to foster this democratic approach within their STIs and how the democratisation has changed over time.

3.2 The Anthropocene

The term *Anthropocene* was initially popularised and coined by Crutzen and Stoermer in 2000 in an issue of "The International Geosphere–Biosphere Programme (IGBP): A Study of Global Change of the International Council for Science (ICSU)". As the title of the newsletter indicates, the term was used in a natural science context as a proposed term to describe a geological epoch. That is, our present geological time in which many conditions and processes on Earth are greatly affected and transformed by human impact. Crutzen and Stoermer (2000) argued that this epoch of human impact on the earth's ecological systems dated back to the late 1800s because "(...) during the past two centuries, the global effects of human activities have become clearly noticeable. This is the period when data retrieved from glacial ice cores show the beginning of a growth in the atmospheric concentrations of several 'greenhouse gases', in particular CO_2 and CH4." (Crutzen & Stoermer, 2000, p. 17).

However, while the term was originally formulated by a biologist and a geologist to describe a geological epoch describing a time of human's impact on global ecosystems, the term has now developed and spread across a plethora of scholarly communities and disciplines, e.g. natural sciences, social sciences, humanities, and arts (Swanson et al., 2015). As such it has been expanded upon, redefined, criticised, and inspired new methodologies and theories in a

multitude of ways (Mathews, 2020). For example, some critics are concerned that the term puts too much emphasis on the power and agency of autonomous human subjects (Haraway, 2015), or at least in particular humans such as white, male, North-Westerners, creating a sense of human exceptionalism or Eurocentrism (Mathews, 2020). Haraway (2015) argues that "No species, not even our own arrogant one pretending to be good individuals in so-called modern Western scripts, acts alone; assemblages of organic species and of abiotic actors make history, the evolutionary kind and the other kinds too." (Haraway, 2015, p. 159). The point being that the term in its original sense puts too much emphasis on humans while disregarding the complexity, relationability, and intertwinedness of all and everything - humans and non-humans. Further, Law (2015) argues that the term may incite or promote a mindset of a "one-world world" that seeks to define a single, authoritative version of reality, stating that "in the 'North' we do not live in a single container universe, but partially participate in multiple realities or a fractiverse" (Law, 2015, p. 134). Meaning that the Anthropocene, as a term in its original proposed form, arguably overlooks contextual, cultural, or indigenous realities and perspectives by following a Western influenced truth linked to a more dominating and hegemonic train of thought.

In the same sense, these are some of the reasons as to why there is no set or definite 'starting point' for the beginning of the anthropocene as well. While Crutzen and Stoermer argued that it should be the late 1800s due to the numerical and traceable spikes in CO_2 and CO_4 recorded, others, as seen above, argue that this timeline dismisses crucial historical events which snowballed into differential harms to global ecosystems that we are experiencing today. Hence, the argument is that we should look at the events leading up to these numerically recorded spikes as equally influential and important in terms of defining the anthropocene and its beginning. While the critique have been grounds enough for some to reject the notion of the Anthropocene in its entirety, others, anthropologists in particular, have found it to be a helpful tool in terms of drawing attention to climate change in a variety of new ways as well as inspiration to broadening one's methodological and theoretical tool kit. For example, notions such as the *plantainocene* (Haraway et al., 2016), *capitalocene* (Moore, 2017), and *chthulucene* (Haraway, 2015) have emerged to address the criticism mentioned above as more encompassing terms for describing the epoch of human impact on the planet and its ecosystems. Similarly, new methodologies such as Tsing's notion of the *patchy anthropocene* have also emerged from this debate. Here the focus is to look at the anthropocene and how we

address environmental climate catastrophe in terms of patches rather than on a planetary scale, as exemplified in her Feral Atlas, however this will be elaborated further upon in the following section.

3.2.1 Patchy Anthropocene

As mentioned, the anthropocene has received a lot of traction within recent years. Academia from different schools predominantly agree that, particularly in light of our current climate crisis, a term to describe the epoch of human impact on the planet's natural ecosystems is helpful, or even overdue. However, it has also spurred a lot of controversy and debate in these circles. Critics are concerned that the term in its proposed definition puts too much emphasis on human precedence, ultimately overlooking the complexity and interconnectedness of the phenomena, humans and non-humans included. Haraway (2015) writes; “The constant question when considering systemic phenomena has to be, when do changes in degree become changes in kind, and what are the effects of bioculturally, biotechnically, biopolitically, historically situated people (not Man) relative to, and combined with, the effects of other species assemblages and other biotic/abiotic forces?” (Haraway, 2015, p. 159). And others are concerned that the anthropocene might encourage a hegemonic Western focused ideology, a “one-world world” (Law, 2015) with little regard to the indigenous cultures, realities, and contexts (de la Cadena, 2019).

To address the above mentioned critique, Tsing et al. (2019) proposes the *Patchy Anthropocene* as a helpful tool to utilise the anthropocene as a term and concept as well as how we might understand the impact of climate change both site-specifically and on a planetary scale. She describes it as being “a conceptual tool for noticing landscape structure, with special attention to what we call ‘modular simplifications’ and ‘feral proliferations’” (Tsing et al., 2019, p. 186). In other words, noticing *landscape structures* reveal patterns of human and non-human phenomena as they emerge through time, while a *modular simplification* can be seen as e.g. a plantation, and *feral proliferation* can be seen as e.g. a plantation-encouraged disease (Tsing et al., 2019, p. 187). Anthropocene patches are then formed from the relation between simplifications (the plantation) and proliferations (the plantation-encouraged disease), and identifying and tracing these relations reveals insight into how and why these landscapes are so prolific and treacherous. This is done in an effort to explore and understand the situated, multi-level, multidimensional, and more-than-human

crisis of today rather than looking at the anthropocene, and the climate crisis, in a more grand, superficial (or Western), planetary context.

For this to happen in practice, she argues that we must pay attention to specific landscape histories and structures as a starting point, and then dive into the "structural synchronicities between ecology, capital, and the human and more-than-human histories through which uneven landscapes are made and remade." (Tsing et al., 2019, p. 186). This specific approach to the anthropocene, and the insights revealed as a result, is exemplified well in Tsing's Feral Atlas. The Feral Atlas is a digital online, interactive map that "invites you to explore the ecological worlds created when nonhuman entities become tangled up with human infrastructure projects." (Tsing, 2021a). It contains 79 field reports from both scientists, humanists, and artists from around the world describing 'feral ecologies', that is "ecologies that have been encouraged by human-built infrastructures, but which have developed and spread beyond human control. These infrastructural effects, Feral Atlas argues, are the Anthropocene." (Tsing, 2021).

This is the essence of a patchy approach to the concept of the anthropocene, and a similar approach will be applied throughout the research within this paper. By using the patchy anthropocene as a conceptual approach, with attention to the patches/landscapes, modular simplifications, and feral proliferations, one will be able to gain a better and more holistic understanding of the climate crisis/food security issue, site-specifically as well as on a planetary scale. An analysis of patches "shows us social formations and ecologies that may disrupt our sense of the whole; patches matter in how we address environmental catastrophe" (Tsing, 2021b). A phenomenological attunement to landscape forms as well as to beings-in-landscapes allows multispecies histories to come into view.

3.3 Situated Knowledges

The term *Situated Knowledges* was coined in 1988 by Donna Haraway in her essay titled *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective* (Haraway, 1988). It was formulated as a way to address and challenge the notion of scientific objectivity in "scientific and technological, late-industrial, militarized, racist, and male-dominant societies (…) in the belly of the monster, in the United States in the late 1980s" (Haraway, 1988, p. 581). Western science culture was heavily influenced by terms

such as neutrality and impartiality, championing these as the cornerstones of modern science. However Feminist Theory, and Haraway (1988) in particular, argued that this phenomenon was problematic in several ways. Not only does this mindset pay little regard to the power relations masked behind neutrality but it also encourages the creation of a partial and hegemonic 'truth/reality' which promotes the position of those in power (white, male, Western), thus making this position universal (Haraway, 1988). This is also what she calls *the God trick*, which refers to how "universal truths get created by disembodied scientists who observe everything from nowhere" (Haraway, 1988, p. 584). In other words, scientific knowledge production that follows the dogma of impartiality and neutrality faces the dangers of promoting their own perspectives, a sort of one-site-fits-all mentality, and often these originate from those in power and/or Western cultures.

On a mission to address these critiques of modern science and objective knowledge production, she formulated *Situated Knowledges* as "a tool for deconstructing the truth claims of hostile science by showing the radical historical specificity, and so contestability, of every layer of the onion of scientific and technological constructions" (Haraway, 1988, p. 578). The term was meant to simultaneously take into account the "radical historical contingency for all knowledge claims and knowing subjects" while acting as "a no-nonsense commitment to faithful accounts of a 'real' world, one that can be partially shared and that is friendly to earth wide projects of finite freedom, adequate material abundance, modest meaning in suffering, and limited happiness" (Haraway, 1988, p. 579). Hence, as the term indicates, it takes the situatedness of the knowledge into consideration - whose perspective is this knowledge produced from - and what is it based on? Accordingly, the argument is that only partial (situated) perspectives can create objective depictions of reality (Haraway, 1988). To further demonstrate her point, Haraway (1988) uses vision as an analogy:

> "Vision in this technological feast becomes unregulated gluttony; all seems not just mythically about the god trick of seeing everything from nowhere, but to have put the myth into ordinary practice. And like the god trick, this eye fucks the world to make techno-monsters" (Haraway, 1988, p. 581).

The idea that we observe something 'objectively' and write it down as the cold hard truth neglects the complexity and variation of the lens from which it is being observed from - it turns us into "techno-monsters". It disregards the influence of the world view, or lens, in

which the observer looks through. For example, while two observers may look at the same object or phenomenon, their perceptions of those may differ greatly because they are looking through different lenses. Haraway (1988) points out that this differentiation of lenses is also reflected through modern technologies such as the multitude of cameras and lenses available - all with different purposes. The world looks very different depending on whether you look at it through the lens of an outer-space satellite or through a microscope. She further argues that "The 'eyes' made available in modern technological sciences shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building on translations and specific ways of seeing, that is, ways of life." (Haraway, 1988, p. 581). The notion of situated knowledges, in combination with patchy anthropocene, has been utilised to situate the three authors, and to situate the perspectives presented by FAO to keep the eye that sees responsible for what it sees.

3.4 Framing of the Bigger Picture

Through the theoretical framework presented above, this thesis aims at exploring the materialisation, performance of and extension of sociotechnical imaginaries in a supranational setting, namely the UN sub-agency FAO. Moreover, to investigate how these STI shape themselves to encompass the complexity of the problem of food insecurity.

The combination of *sociotechnical imaginaries* and *civic epistemology* have provided the theoretical framework for the analysis of this thesis with insight into what types of collective visions and assumptions regarding the future of food (in)security exists, and how FAO are trying to achieve those visions and trying to resist the negative imaginary of increased or continued food insecurity in the world. With the application of civic epistemologies, it has been possible to investigate and highlight how FAO is trying to achieve and/or resist these visions or imaginaries with a wide range of different tools, including scientific knowledge with a focus to empower the communities and nations suffering from food insecurity and enable the nations of food abundance by creating systems and programmes to help alleviate the pressure on the worldwide food system. Moreover, the application of this theoretical framework helps create insights into how FAO utilises and values knowledge and research from a food and agricultural perspective, and insights into how FAO supports the implementation of research practices across the member states of FAO and the UN. Overall, the combination of *sociotechnical imaginaries* and *civic epistemologies* have allowed us to

create insights into the understanding of the interplay of knowledge, technology, and society in the context of food (in)security.

The lens of *the anthropocene* provided the analysis with the theoretical framework to understand the problem of food (in)security and how this problem has to some degree intensified due to climate change. Climate change is in itself a complex issue that has highlighted the disparities of the consequences of how humans have interacted with the world and its resources. Thus, allowing this analysis to investigate how climate change and the anthropocenic era have influenced the imaginaries of the future within the setting of FAO, how knowledge and knowledge production regarding these consequences and how to mitigate them, influences the topic of food (in)security from an institutionalised perspective. By understanding the unevenness of the distribution of consequences both within and across national borders, Tsing's notion of the *patchy anthropocene* has been utilised to create a more nuanced understanding of the global problems, climate change and food (in)security. Furthermore, the *patchy anthropocene* in combination with *situated knowledge* has provided insights into how FAO works with the local and situated perspectives of food (in)security.

4.0 Methodology

The following section will present the methodological approaches adopted within this thesis. Initially, a short presentation of the concept digital methods, *the slalom method* as the overarching methodological approach for this thesis. Second, a presentation of the notion of *quali-quantitative approaches* and how this notion has been deployed throughout the analytical process of this thesis. Followed by a short presentation of the data collection process, and lastly, an introduction to BERT-modelling and the application of close and distant reading during the analysis.

4.1 The Slalom Method

Before going into depth with the tools applied in the data collection and as a foundation for this thesis' analysis, a short introduction of digital methods is necessary. In the words of Richard Rogers; "(...) digital methods may be considered the deployment of online tools and data for the purpose of social and medium research" (Rogers, 2017, p. 75).

Digital methods are based on the application and utilisation of online methods, usually referring to techniques traditionally speaking from the field of computational and information sciences. In regard to this thesis, the utilisation of digital methods have been deployed with the aim of doing social research rather than medium research. Rogers, like other authors within the field, differentiates between utilising digital methods as a means to investigate social trends or how and for whom the digital medium works, often as a critical inquiry into the consequences of algorithms behind i.e. the Google search engine (Rogers, 2017). Furthermore, Rogers argues that the use of digital methods aimed at social research, offers the opportunity to investigate and study dominant voices, commitment and concerns within the specific social field of research.

Some of the opportunities Rogers refers to is due to "(...) our social, organisational, political, commercial and academic life is now increasingly digitally mediated and enabled" (Jensen, 2022, p. 2) and as a consequence of the digitisation of society and all its sectors a wave of new phenomena to be investigated by social sciences have been created. These new phenomena have also created new opportunities within the field of ethnographic field work. In "The Slalom Method" by Torben Elgaard Jensen (2022), a wide range of problems and

opportunities in ethnographic fieldwork sprung to life by the digitised era is discussed. Moreover, Jensen proposes a method for researchers to circumvent and handle some of the problems and dive into some of the opportunities that the digital world offers. This methodological approach was utilised throughout this thesis, especially in the visualisation of the literature review, data collection through online media, and the initial analysis process through the application of BERT-modelling.

The aim of the slalom method is based on the metaphor that lies within the name, 'slalom', symbolising a complementary and iterative approach to the utilisation of digital methods in ethnographic work, and as something that cannot be pre-planned. The slalom method argues that it aims at supporting and developing the researcher's sense for being able to shift back and forth between methods when the time is right. Thus, building upon the nature of ethnographic field work being "an engaging and often unpredictable learning experience, where our conceptions of the field evolves and changes in tandem with new questions, reflections and emerging empirical opportunities" (Jensen, 2022, pp. 3–4). Underlying this understanding, is the idea of digital data as additional resources in the exploratory and iterative process of ethnographic fieldwork, which truly came to light when we ventured into the literature review of this thesis. Though the view on digital data objects as a resource is not without problems, as previously mentioned, with the introduction of new resources the conditions for doing research are challenged and transformed. Jensen raising the argument of "(...) how should we be reflexive about our fieldwork when some of the underlying data sampling and algorithmic production process are beyond our control" (Jensen, 2022, pp. 2–3), when including i.e. complex network graphs in ethnographic fieldwork and ethnographic sensemaking. Some of the critical and reflexive questions regarding the utilisation of digital methods, will be discussed in section 6.2 Discussion of & Reflections on Research Design.

Further, Jensen (2022) has identified four areas of method integration problems to which the slalom method should help the researcher navigate; *problem of priority, problem of integration, problem of digital data quality,* and *problem of logistic*. The first problem is concerned with the "(...) question of deciding whether to put more faith in quantitative or qualitative methods of a project" (Jensen, 2022, p. 5), this notion of having a predetermined or fixed priority of methods is juxtaposed to the iterative exploration of traditional ethnographic fieldwork. Thus, the slalom method presents itself as iterative and not prefixed, hence having

an understanding of quanti-qualitative digital methods being an enriching factor to the fieldwork. Problem number two is concerned with the combination of different sources of data, i.e. "(...) in-depth ethnographic interviews and large datasets harvested online" (Jensen, 2022, p. 6). The third problem is one of the imagined hopes and dreams "(...) of comprehensive, continuous, well-ordered and clear information about society" (Jensen, 2022, p. 6) within Big Data, which often in reality is messy and complicated. This problem requires the ethnographer to evolve pragmatic selection criteria, and a critical position towards bias within data. The fourth and final problem that Jensen raises is one of logistics. Time limits and other resource based restraint and frames is given for all and every project, thus forcing the researcher to decide and allocating enough time to learn and utilise digital methods, and "(...) finding the right time to use digital methods during a fieldwork project" (Jensen, 2022, p. 7).These different challenges and how they have affected the process of this thesis, will be presented in section 6.2 Discussion of & Reflections on Research Design.

4.2 Quali-Quantitative Approaches

As a supplement to the slalom method, the thesis also takes an outset in a quali-quantitative approach, namely the complementary approach defined by Anders Munk in "Four Styles of Quali-Quantitative Analysis" (2019). At the centre of ethnographic work is the methodological problem of meaning making, or relaying the 'native point of view' to use Malinowski's term; this issue is also present with the introduction of online data or online traces. Raising questions such as "(...) how these traces were intended, what they meant in their original context and, indeed, what that context was" (Munk, 2019, p. 160). Munk highlights some of the similarities regarding the problem and solution of meaning-creation and the creation of the native point of view that both ethnographers and digital sociologists encounter; arguing through the understanding of Malinowski as the embodiment of the cross pollination of qualitative and quantitative data as a solution to the meaning making within the field of anthropology, that digital methods is in a similar position. Within this position, online traces and phenomenons offer a fascinating "(...) potential for being both data traces and venues for qualitative work at the same time" (Munk, 2019, p. 163).

Munk suggests four different types of quali-quantitative analysis to address the meaning problem in their own way; *the complementary, single-level analysis, curation*, and

algorithmic sensemaking (see table 1). In line with the slalom method, the complementary approach offers the researcher freedom to choose between and when to apply methods from the qualitative or quantitative repertoire, making the researcher the responsible party for argumenting for why, where and when each method should, could and/or shouldn't be applied, and how they supplement or contradict each other (Jensen, 2022; Munk, 2019). Inherently in the complementary approach is the understanding of each approach "(...) contribute valuable insights but must be left to their own devices to do so (...)" (Munk, 2019, p. 164), thus living on the premise that each methodological school is fundamentally different, and that they should co-exist. This approach was utilised throughout the thesis, especially in the creation of visualisations of different kinds (literature review and BERT-modelling), that functioned as the foundation for further inquiry through close and distant reading; these reading approaches, will be further elaborated upon in section 4.3.2 Distant & Close Reading. Moreover, a discussion and reflection of how this method has impacted the thesis will be elaborated in section 6.2 Discussion of & Reflections on Research Design.

The quali-quantitative as:	**Addresses the meaning problem by:**
Complementary	Interpreting insight from a quantitative analysis of onlife traces by situating these insights qualitatively in the everyday environments that they claim to reflect.
Single-level analysis	Tracing how quantitative patterns on the macro level emerge directly from qualitatively rich interactions on the micro level, demonstrating how onlife traces simultaneously embody both qualitative richness and quantifiability.
Curation	Critically reappropriating (and thus manually curating) onlife traces to speak on behalf of certain phenomena or address certain questions.
Algorithmic sensemaking	Attempting to reveal emic modes of ordering the world through quantitative techniques, for example pattern recognition.

Table 1: "Four styles of quali-quantitative analysis" (Munk, 2019, p. 164)

4.3 Data Collection & Analysis

Section 4.3 and its sub-sections have been written to create an outset for the reader to gain insight into the data analysis of this thesis. The data that have functioned as the empirical foundation for analysis, consist of 71 extracted sections of the yearly report by FAO (see

appendix 3). The sections included in the data corpus are the paragraphs called “Foreword”, “Summary”, “Main Problems” or “Key Findings”. The reasoning behind choosing different sections is due to changes in formatting in the FAO reports over time, and through qualitative skimming of the reports, these sections were found to be similar in structure and contents. Thus providing the best empirical foundation to have a comparative and historical perspective forming in the analysis.

The following section has been divided into two subsections, one concerned with the introduction of BERT-modelling and its use throughout this thesis, and the second subsection will introduce the notion of close and distant reading which have been the main approach to the analysis and sense-making process of the empirical data. The rigidity and linear impression inherent within the structure of the data collection presented above, is not a true depiction of the reality of the process, which has been iterative, dynamic and messy. Thus, the breakdown of the process into subsections was chosen only to create structure within this thesis and to help the reader.

4.3.1 BERT-Modelling

Before going into detail with how we have utilised and implemented BERT[2] into this thesis and analysis, this section will also give a short presentation of how the state-of-the-art NLP technology BERT’s functionalities. Including a short presentation of NLP, and the differences between BERT and DistilBERT, which is the version we have utilised.

NLP “is a collection of computational techniques for automatic analysis and representation of human languages” (Chowdhary, 2020, p. 604) which is a subset of computational linguistics. Computational linguistics refers to the study of the understanding and generating of natural language by computer systems, this field of research is usually divided further into two areas: theoretical linguistics and computational linguistics. The first being “concerned with language universals - principals of grammar which apply to all natural languages” (Chowdhary, 2020, p. 609). Whereas computational linguistics refers to the study of natural language analysis and language generation. A fundamental for NLPs is different pre-processing techniques that categorises and structure the extracted words and sentences from the language data provided to the given NLP. These pre-processing techniques include: tokenization, PoS tagging and

[2] https://colab.research.google.com/drive/1UUttQIToG5EoiH5WpYcM-Fcoe8SE13ez?usp=sharing

parsing (see section 2.1 for PoS explanation). Tokenization refers to the process of splitting of sentences or documents into words or phrases, followed by these chunks of text or words being labelled as tokens. The parsing process aims at computing mathematical, grammatical, and statistical information used for structural description of a sentence (Chowdhary, 2020).

Due to developments in deep learning NLP models have experienced increasing improvement in regards to language processing, resulting in improvements in the usability of NLPs in areas from sentiment analysis to question answering. Deep learning, deep structured learning or hierarchical learning is a subset of machine learning, which builds upon how the human brain interacts and obtains knowledge - through neural networks. Thus the goal is to create artificial neural networks, which through consumption of large amounts of data, learns multiple levels of representation to model intertwined and complex relationships among the data consumed (Amaratunga, 2021).

BERT (Bidirectional Encoder Representations from Transformers) is one of NLPs that have improved due to this development. BERT builds upon the two recent trends of transfer learning and the Transformer model within the field of NLP. The notion of transfer learning refers to the training of a model in one task, “and then leverage the acquired knowledge to improve the model’s performance on a related task” (Vig, 2022). Whereas the trend of the Transformer model utilised a “(...) neural network that accepts a sequence as input (e.g. a sequence of words) and produces some output (e.g. sentiment prediction)” (Vig, 2022). BERT allows for the measurement of similarity between words across a corpus of text, by turning word/tokens into vectors - “essentially, a list of numbers in a coordinate system (x,y). We can (...) use the geometric similarity between these resulting vectors as a way to represent varying similarities between words” (BERT for Humanists & Søltoft, n.d.). BERT also offers the possibility to look at a single word through these vectors to map the different uses of a singular word and further investigate the context of how the word is being used, and how the word or its context have changed over time. In this thesis the DistilBERT have been utilised, it has the same properties and functionalities as BERT, but has 40% less parameters, “while retaining 97% of its language understanding capabilities and being 60% faster” (Sanh et al., 2020, p. 2). DistilBERT is free to access and use, it has a fairly easy initial learning- and using curve, and due to the limited timeframe of the thesis and the fact that it was a digital method

we haven't utilised before, these factors weighed heavily into our considerations. These considerations stem from the understanding and application of the *slalom method*.

4.3.2 Distant & Close Reading

As mentioned earlier in the methodological section, the digitalisation of society and all its sectors have also influenced the possibilities of the humanities scholars. Within the realm of studies including literary works the digitalisation has provided a foundation for easier access to many digital text, making possible the "(...) shift from reading a single book "on paper" to the possibility of browsing many digital texts (...)" (Jänicke et al., 2015, p. 1). This browsing and access to a plethora of literary text being one of the pillars of the domain digital humanities (Jänicke et al., 2015). With this aforementioned shift and new possibilities, the phenomena of distant reading arose, but before introducing reading from a distance, the notion of close reading will be presented.

Close reading refers to the traditional process of uncovering meaning through analysis of any given literary work, "essentially, close reading means reading to uncover layers of meaning that lead to deep comprehension" (Boyles, 2013, p. 1). Thus, close reading offers the possibility of analysis by thorough interpretation of text, with its analysis focusing on; used words and phrases, argument patterns, text structure and style, and lastly "(...) individuals, events, and ideas, their development and interaction" (Jänicke et al., 2015, p. 2). This type of analysis is often conducted through various annotation methods for essential and important features for analysis - this annotation can be done both in analogue and digital texts. Moreover, a focus of close reading is to read a source text, extract meaning without dissolving the structure of said text, which is the exact opposite of distant reading.

Distant reading aims at creating abstract approaches or views of literary works, both single or multiple texts, through the utilisation of visualisations (Jänicke et al., 2015). In 2005 Moretti introduced three types of distant reading: graphs, maps and trees (Moretti, 2005). Within this thesis, the two first types have been utilised on three instances; graphs to create timeline overviews of the development of trends in the FAO reports, BERT modelling in the shape of coordinate systems, and a map in the form of the multi-term co-occurrence network in the literature review. The distancing from specific texts have helped the three authors create the initial abstract overview. Thus, following Shneiderman (2003) thought; "overview first, zoom

and filter, then details on demand" (Shneiderman, 2003, p. 1). Whereas the zoom and filter as well as details on demand have been actualised through the interactive relationship between close and distant reading, visualising and highlighting any interesting patterns within the data from a distance, and then following these interesting phenomena for further close exploration (Jänicke et al., 2015).

This approach has been applied in the creation of the multi-terms co-occurrence network of the literature review, and supplemented with close reading of specific texts that supplement the topic identified from a distance through the network, supported by digital method tools (see section 4.2 Quali-Quantitative Approaches and 4.3 Data Collection & Analysis). Furthermore, the notion of distant reading has been applied with the utilisation of BERT, creating coordinate systems of specific words and how they differ in usage through the word's context (see section 4.3.1 BERT-Modelling). Inherently, in the BERT visualisation lies the option of a combination of distant and close reading in a iterative form - the nodes (which represents a given word) is interactive, by clicking on a given node, you are transported to the report from which the word have been extracted, offering the possibility to shift to a close reading approach of a specific report. This interactivity, forming an iterative approach, have been instrumental to decode and create a deeper level of comprehension and understanding of the different STIs that appear throughout the flagship publications, The State of Food & Agriculture, by FAO.

4.4 Assembly Manual

The methodological approach of this master thesis was chosen due to the encouragement of exploration and iterative approaches which was the preferred approach to the field of food (in)security from an institutionalised perspective, due to our minimal pre-conceptual understanding of said field.

Due to the exploratory nature of the problem statement and the aim of this thesis: to explore and understand sociotechnical imaginaries in FAO, and how these imaginaries materialise, are performed in and extended across the globe through time. It was deemed necessary to conduct the research through an exploratory methodological framework, which we found in the combination of the slalom method and the complementary quali-quantitative approach, and by

utilising the methodological tools of BERT-modelling in combination with close and distant reading.

Furthermore, the combination of the slalom method and the complementary quali-quantitative approach utilised in this thesis, was based on their shared emphasis on allowing for the exchangeable utilisation of digital methods, BERT in our case, more traditional ethnographic methods, and between qualitative and quantitative methods.

Moreover, the combination of BERT-modelling and the application of close and distant reading compliments each other well, due to the nodes in the coordinate systems created by BERT being interactive. Thus, the coordinate system offers a distant picture of the given word and the similarity of its context over time and in the different FAO reports, while the interactivity of nodes has encouraged a closer examination of specific contexts, thus offering the close reading perspective at the same time. Hence, fostering the iterative and exploratory approach deemed important and necessary for the thesis by the three authors.

5.0 Analysis

To answer the problem statement, this section will consist of an analysis of the collected data consisting of 71 'State of Food and Agriculture' reports by FAO. For continuity, the structure of this section is divided into two main sections, one shortly introducing UN through the lens of STI, followed by an introduction of the main STI identified within the realm of FAO. The section about FAO is further elaborated upon through six subsections. Henceforth, the analysis will begin chronologically from when the first FAO report was published in 1947, and take you on a temporal journey to identify relevant *sociotechnical imaginaries* and *civic epistemologies* as inspired by Jasanoff (2005; 2015). This was done to explore how societal aspects related to technology may be reflected in decisions made by FAO regarding the prioritisation and policy-making related to food (in)security. Further, theory on the *patchy anthropocene*, as inspired by Tsing (2021a; 2019) and the notion of *situated knowledges*, as inspired by Haraway (1988), will be applied to the findings to discuss the significance of these concepts within the institutional and organisational field to gain a holistic view of the increasingly multifaceted and complex debate surrounding food (in)security.

5.1 United Nations Sociotechnical Imaginary

As mentioned in section 1.2.2 The United Nations, the UN was founded in the aftermath of WWII to prevent further war; a means for nations to commit to international peace and security with a strong focus on maintaining good relations across nations. The UN writes, upon signing the Charter, that "the hope of many years had materialized in an international organization designed to end war and promote peace, justice and better living for all mankind" (United Nations, n.d.-c). Evidently, the dominant STI during this founding period was characterised by the notion of world peace and to not fight wars amongst each other; there was a socially collectively held desire for peace and stability after having lived through years of warfare which ultimately materialised in the shape of the UN. While this notion of world peace is still a foundational pillar in the UN, the world and its problems have evolved, consequently so has the work and purpose of the UN. This is reflected in the current STI embedded within the UN, which portrays a much more expanded and broad sense of priorities and values. Today, the UN describes themselves as the "One place where the world's nations can gather together, discuss common problems and find shared solutions that benefit all of

humanity" (United Nations, n.d.-a). Meaning, they understand themselves as a sort of platform, or facilitator, for nations to work together. The multitude and variety of aspects which the UN concerns itself with is reflected in e.g. the Millenium Declaration from 2000 which focused on "freedom, equality (of individuals and nations), solidarity, tolerance, respect for nature and shared responsibility" (United Nations, 2000), or the more recently established Sustainable Development Goals from 2015 which included 17 focal points ranging from a broad spectrum of gender equality, zero hunger, to climate action. Thus, reflecting the collectively held STI in the UN.

Further, as these problems expand over a large array of domains and localities, several sub-agencies within the UN have been created to deal exclusively with their designated field of expertise. It could be argued that all of the sub-agencies, as part of the UN, align with the general STI characterised by world peace as embedded and enacted by the UN, but simultaneously they have their own modified sub-STI adapted to their focus area. For example, among these sub-agencies is the Food and Agriculture Organisation which has been the sole focus of this thesis. In the following section the identified STI existing within FAO will be presented followed by an exploration of the temporal trends which has affected and shaped the evolution of the STI held by FAO.

5.2 FAO's Sociotechnical Imaginaries

By understanding STIs as collectively held visions of how the future should shape itself, as well as resistance visions against a not wanted future, which is durable over time in the setting of FAO, it becomes evident that the STIs of UN and its sub-agencies have been and is to some degree an intertwined network. The STIs are fluid, hence they overlap and create some messiness or ambiguity. Thus, the following section will start of with an introduction of the main STI identified throughout the entire time period of the reports 'The State of Food & Agriculture' and continue down the rabbit holes of specificities of the sub-STIs that have emerged and changed over time, and how these are connected to *civic epistemologies*.

To be able to achieve peace and security there must be enough food for everyone; Food is a human right as declared in 1948 (United Nations & FAO, n.d.); Humanitarian aid often equals food supplies; Producing food for a growing population takes a massive toll on the environment contributing to the global climate crisis; And access to food is a human right

recognized under international law as well as being an incremental component for many nations in terms of international trade, thus international trade policies. The point being, food is intertwined and connected to all aspects of the UNs core mission. Hostilities have a negative effect on food security and the food system, and in turn the lack of food and water security increases the risks of hostilities. This intertwined relationship is clearly depicted throughout the FAO reports from their beginning in 1947 and up through modern times, as it will be reflected in the following subsections

The overarching STI for FAO and their work is the vision of zero hunger, clearly present in their aim formulated as follows: "our goal is to achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives" (FAO, n.d.-a). Agriculture as a technology and its practices are in the eyes of FAO the practical solutions to what they identify as the twin problems of rural poverty and inadequate food supplies (1959), overall this paints the picture of agriculture as part of the solution to end world hunger, poverty and in more modern times, part of the solution to the climate crisis, from the perspective of FAO.

This understanding of agriculture and the main STI has not changed much over the times, but due to technological, scientific, and societal development it has evolved to include the new societal changes and the technoscientific innovations as well as the problems that follow in the wake of new discoveries and changed social order. These changes and developments manifest themselves through temporal trends which have affected the STI held by FAO. In table 2 below, you will be presented with an overview of the identified temporal trends and their effect on the STI that have been present throughout time. Table 2 has been divided and categorised in time periods to ensure a clear picture of the significant historical events that influenced the given period of time, and thus the visions of possible futures. This approach was taken instead of a division and categorisation based on the STIs themselves, due to their fluid, messy, and ambiguous nature. Each period of time has been given its own sub-section in the analysis, so let us venture through the times.

Period	Historical Events	FAO's Main Focus & Actions	STI
1947-1958	Post WW2 years Technical Assistance Programme (Marshall Plan, 1948-49)	First State of Food & Agriculture report in 1947	End world hunger by increasing production, using more mechanisation, fertiliser, pesticides, and technology transfer.
1959-1969	The Cold War First Development Decade (1960-69)	Freedom from hunger campaign by FAO First World Food Congress in 1963	End world hunger by increasing knowledge and technology transfer, which will improve less-developed regions' self-reliance and self-dependency.
1970-1982	"The Green Revolution" Oil and financial crisis Second Development Decade (1970-79)	Conference on the Human Environment (1972) First World Food Day is held (1981)	End world hunger by continuing the work from previous periods, by e.g., introducing high-yielding varieties, and promoting global cooperation to mitigate growing disparities and environmental degradation.
1983-1999	Fall of the Berlin Wall Third Development Decade (1980-89) Our Common Future Report (1987) End of the Cold War Fourth Development Decade (1990-99)	Introducing the term food insecurity and sustainable development in their reports Code of Conduct regarding pesticides (1985) First World Food Summit on Food Security is held (1995)	End world hunger by increasing production of food, but sustainably to prevent further destruction of ecosystems. As well as changing the actions to end world hunger to include social and economic factors in an increasingly globalised world.
2000-2009	The Millenium Declaration (2000) "The Gene Revolution" (GMO) 9/11 hostilities Financial crisis (2008)	Conduction research regarding the safety and sustainability of biotechnologies	End world hunger by introducing new sustainably oriented technologies, though remaining cautious towards potential risk and local specificities regarding implementation measures.
2010-2021	Sustainable Development Goals (2015) Covid-19	Hand-in-Hand Initiative is launched First Food Systems Summit is held (2021)	End world hunger by producing more food with less resources to mitigate climate change, while improving gender equality in agriculture, raising rural incomes, and increasing diversity to improve the resilience of the global food system

Table 2: Overview of the Temporal Trends in the STI held by FAO

5.2.1 More is Better (1947-1958)

The first period outlined within this section spans from 1947 to 1958 and is a period heavily influenced by a sense of post-war centeredness. As mentioned in section 1.2.2 The United Nations, the UN was founded in 1945 in the aftermath of WW2 as an attempt to unify nations, to foster good relations, and ultimately prevent further war. It was the beginning of a new chapter for a world longing for peace and stability. This is heavily reflected in the analysed "State of Food Agriculture" reports as well. For example, every report from 1947 and all the way up to 1962, the reports compare the current state of food and agriculture to pre-war levels, meaning it is a constant point of reference for more than a decade after the war. This is exemplified in the selected quotes below:

> "(…) the volume of world trade in agricultural products in 1955 so that it reached the highest level since the war."(1956)

> "World production of wheat decreased slightly, exports rose sharply to reach a postwar peak (…)" (1957)

> "(…) there was, for the first time, a check in the steady postwar expansion in the world agricultural output." (1958)

This notion of getting the food production output to how they were before WW2 is also characterised by a 'more is better' mentality as reflected throughout this entire period. There is a constant sense of urgency to produce more food to reach pre-war levels specifically. However, the reports also express concern that "Restoration of food output to pre-war levels is not enough. World population is increasing by 15 to 20 millions each year, and consumer demand for food is everywhere higher than before the war." (1947). So not only is there a desire to reach pre-war production levels but they also have to surpass those levels in order to feed a rapidly growing population with increasingly higher living standards. In terms of how this may be achievable is where the STI embedded in FAO truly reveals itself:

> "Agricultural modernization is needed to increase output per acre (...) More fertilizers, farm machinery, and pesticides could be delivered within the next six months to areas of great need." (1947)

> "(…) such improvements as those could increase production 10 or 20 or 50 percent in a relatively short time and so provide more and better food for millions of hungry human beings. They are the first steps. The bigger developments in farm mechanization and other large-scale advances will follow." (1949)

> "Improvements in technology, reflected in increased yields per hectare and per animal, have played the major part in the postwar expansion of production (...) New synthetic pesticides and selective weed-killers have made a considerable contribution to maintaining and increasing yields." (1955)

As reflected in the highlighted quotes above, according to FAO within this period, modernization and mechanisation of agriculture is the solution to the world's current and future pressing food crisis. Here, the collective vision of the future to achieve food security is perceived as accomplishable through more technology, more pesticides, more fertilisers, and more technological knowledge transfer. The STI embedded within FAO, and thus the way in which they navigate the challenge of securing food for everyone - both in the developed and the "under-developed" (1951) world, is shaped by societal factors such as a desire to reach pre-war food production levels, and even surpass them, to feed the newly unified world.

Further, the notion of 'more is better' and FAO's prioritisation of efforts is underlined by how they address food in terms of quantity and quality. There is a much more central focus on increasing production output as compared to ensuring a variety of nutritional food. The only mentions of the nutritional profile of food is in the 1947 report where FAO refer to the "so-called vitamins" (1947), and in the 1956 report where they state that "Recent progress in the more advanced countries has been mainly in the quality and variety of diet. In the less developed regions improvements have shown themselves largely in increased calorie intakes (…)" (1956). Referring to vitamins as an almost foreign thing, as the "so-called vitamins", seems peculiar in contemporary society, however in the late 40's vitamins were still a fairly new discovery. Thus, there was a greater focus on producing more, which fights hunger, as opposed to producing nutritious food, which fights malnutrition. Whether this is consistent throughout the identified periods, or whether there is a shift of focus as a consequence of societal factors, will be explored further in later periods.

Interestingly, the years when food production output increased, met satisfactory levels, or exceeded expectations (which was reported occasionally within the reports - often due to

favourable weather), the focus then turned to the uneven distribution of the ressources. Often, when there was a surplus of food, it did not necessarily mean that the number of hungry people went down. Rather, while the developed world would have a surplus, the developing nations was suffering from shortages, as exemplified below:

> "(...) accumulation of surpluses in some countries while shortages persist in others." (1948)

> "The expansion of agricultural production has been most uneven. In North America it has greatly surpassed the growth of population. In the Far East, at the other extreme, total production has barely regained its prewar level and is still 15 to 20 percent below the insufficient prewar per caput level." (1953)

> "(...) production was unevenly distributed, and in 1953 heavy surpluses of certain commodities accumulated in some countries, though, there was little improvement in the diet of millions of inadequately fed people over large areas of the world." (1954)

This disparity and unevenness was further fueled by postwar loans and grants with favourable shares going to the developed countries, putting the developing nations in a disadvantaged position. It is argued that this disparity reflects a clash in values between some nations and FAO - at least in terms of what a desirable future looks like and what it takes to get there. FAO writes that "There is often a tendency to look to the export market for the solution of surplus problems" (1954), meaning (developed) nations with surpluses capitalise on these through export to further improve their own position instead of helping other (developing) nations. While FAO embodies the STI from the UN of being unified and working together, nations showed a tendency to disregard this in a self-serving manner. This tendency may be affected by the post-war centeredness as previously mentioned; a sort of protectionism. After years of war, instability, and uncertainty, it could be speculated that the sense of being comfortable and having a surplus of resources leaves little incentive for nations to share their surpluses.

This notion of lack of incentive and unevenness can be further underlined by the way nations were choosing to prioritise other expenditures, e.g. on military. In the 1951 report, FAO writes that "There is a real danger that in the planning of huge defence programs, agricultural requirements may be overlooked." (1951). Meaning, nations were increasing their defence

expenditures which caused grounds for concerns within FAO as this conflicts with the STI embedded in FAO where food security is valued more of a necessary priority as opposed to military defence. Again, it also reflects the disparity among nations where some were able to increase military expenditure, while others were struggling to feed their populations.

It can be argued that this is a form of resistance to the STI promoted by FAO as nations showed a reluctance to 'comply' and acted differently than what would be in accordance with FAO's primary goals. The lack of traction for FAO's STI may be understood through Tsing's notion of the patchy anthropocene, stating that we must dive into the "structural synchronicities between ecology, capital, and the human and more-than-human histories through which uneven landscapes are made and remade." (Tsing et al., 2019, p. 186). By thinking of the world in terms of patches as opposed to a planetary unit, we may understand the situated, multi-level, multidimensional, and more-than-human phenomena and reality in which nations exist. Because the agenda of FAO is indeed very planetary focused, it views the world (or at least its member states) as a whole; a single unit. However, as previously mentioned, this was still a time influenced by the aftermath of war, and every single country was affected differently. Nations are situated in their own patch before they become part of the world as a unit, meaning each patch has its own set of values, beliefs, concerns, and priorities - all shaped by differing ecologies, capitals, and the human and more-than-human histories present within this patch. It is these factors that may have contributed to certain nations resisting the STI promoted by FAO as they have a different vision for the future - and how to achieve it.

The way in which the world was perceived by nations and FAO in terms of patches and situatedness is further exemplified in the 1947 report. Africa and Latin America were referred to as "Two safety-valves for relieving the growing pressure of world population upon the world food supply (...) Both continents are sparsely populated, with great undeveloped or partially developed land resources. Both could produce food far in excess of their own needs." (1947). This idea of Africa and Latin America being two safety-valves, being able to produce food for the rest of the world with their bountiful and underutilised lands, stands in stark contrast with the reality of today's contemporary society. However, this statement reveals insight into how society perceived agriculture and food production within this period, as well as how *situated knowledge*, as according to Haraway (1988), influenced this. From a western

and modern perspective, lots of land meant more land for agriculture. It was an untapped potential and opportunity for modern agriculture to expand, thus produce more food. However, this could be a reflection of Haraway's so-called *God trick* which refers to how "universal truths get created by disembodied scientists who observe everything from nowhere" (Haraway, 1988, p. 584). As reflected in the reports within this time, the STI embedded in FAO reflects a mindset of technology and modernization being the answer to the whole world's food problems. More agriculture, more mechanisation, and more fertilisers, equaled more food. However, this creates a very partial perspective, a sort of one-site-fits-all mentality, and often these originate from those in power and/or Western cultures. Within this period, there is observed very little concern for the situated knowledge and locality within the separate patches, thus there is a real risk of creating hegemonic and universal solutions within FAO in terms of creating food security. This lack of consideration for locality and the one-size-fits-all mentality may ultimately be another contributing factor to the resistance observed towards FAO's STI. Whether this perspective evolves over time - and if so, to what extent, will be explored throughout the following periods.

The way in which FAO considers the world on a planetary scale is further reflected in the way they try to appeal to nations. In the 1951 report they argue that by prioritising food and agriculture (e.g. military expenses), everyone will benefit, (and not just particular 'patches'). They state that "(...) the needs of both the developed and the under-developed regions, assurance of adequate supplies for agriculture is a prime necessity in the period ahead. Even if it means further slight limitations of heavy goods for consumers in the highly industrialized countries" (1951) and that the "modest sacrifice on their part will be in their own interest, as well as a humanitarian contribution to a better world." (1951). Here, FAO is appealing to the morality of nations as well as creating an incentive for each individual 'patch' to benefit from this. This may have worked because during the mid 50's a slow transition or acceptance towards the STI within FAO is slowly starting to materialise in the shape of policies, as reflected below:

> "Many governments are now beginning to reshape their agricultural policies to the new circumstances." (1954)

> "Growing agricultural surpluses, mainly in the more developed countries of the world, have led increasingly to policy measures to restrain further expansion, and for some years

> these, have led to a considerable slowing down of the tempo of agricultural development." (1958)

> "By contrast, the rate of agricultural expansion in the less developed countries has generally been well maintained, a part from the vagaries of weather, particularly for the major part of their output which, is destined for their own consumption." (1958)

Meaning, policy measures were implemented in the developed countries to slow down agriculture, thus lessen the surplus. This is beneficial to developing countries in terms of trade because surplus influences the international trading market by adding pressure on developing countries to buy foodstuffs instead of investing in their own agriculture. With this increased acceptance of FAO's STI promoting universal prosperity through food security, we see a shift in the STI. These policy measures can be seen as an acceptance and materialisation of the STI promoted by FAO, thus it is gaining more traction.

So, to reiterate the findings within this section; The period from 1947-58 is a time heavily influenced by a post-war centeredness and a 'more is better' mentality. This is reflected in the way the reports constantly refer to pre-war levels as well as stressing the urgency to not only reach these pre-war levels of production output, but there is a need to surpass them to feed a growing population. This translates into an encompassing focus on intensifying production and producing more food. This is achieved through more modernisation, mechanisation, pesticides, fertilisers, and technological knowledge transfer, thus also reflecting the dominant STI within this period. However, the STI is argued to carry traces of the God trick, meaning the solution to food insecurity is very hegemonic and universal, with very little consideration to situated knowledge, patches, and locality. Ultimately, this creates a form of resistance to the STI embedded in FAO. Although, in the late 50's, a shift was observed in the shape of agricultural surplus policy measures. This indicates a sense of acceptance towards FAO's STI, thus the transition to the next period has been made here.

5.2.2 Give a Man a Fish (1959-1969)

> *"… and you feed him for a day; teach a man to fish and you feed him for a lifetime."*

At least that is how the saying goes. However, the meaning of the common saying, as reflected above, is very indicative of the mindset and STI observed within this period. While the main STI of FAO is still present; that is to end world hunger through advancements of

agricultural practices, there is within this period from 1959 to 1969 an increased focus on enabling developing countries to be self-sufficient. It is also a period characterised by the introduction of the UN concept of Development Decades, with the first Development Decade running from 1960-1969. As part of this initiative FAO launched the Freedom from Hunger campaign. The aim of the campaign "(...) was to eradicate hunger in the world once and for all" (FAO, 2015). This period is also characterised by the fact that agricultural production reached pre-war levels, but due to increasing birthrates, a further increase in production output is needed to ensure enough food per caput. Thus the STI from the period before, 'more is better' continues into this decade. The idea of more is better changes form to some degree, instead of a focus on having more of everything, it shifts to a focus on knowledge and technology transfer from developed countries to less developed countries and regions to foster a sense of self-dependency and self-reliance within developing countries, as, reflected in many of the reports from this period below:

> "FAO has always emphasized that the ultimate solution to the problem of hunger and malnutrition in the less developed countries can be found only by raising their own agricultures to a much more productive level" (1961)

> "During the past century agricultural science has developed with an increasingly rapid tempo and in the countries where it has been applied it is no exaggeration to speak of "the agricultural revolution".(...) To adapt this growing body of knowledge to the arid or tropical climates of most of the less developed countries, and to persuade the farmers to accept and apply this new knowledge, is an immense task." (1961)

> "Food aid from the United States is to be increasingly linked to agricultural self-help measures in the recipient countries. This is a most welcome development, for the aid most urgently needed by the developing countries is for the building up of their own agriculture" (1967)

To ensure the success in implementing this 'help to self-help' approach and the initiatives that follow in local nations, FAO had a focus on employing knowledge systems as an empowering tool for developing countries. Arguing that:

> "One of the most important areas of government responsibility is research. The provision of industrial training is an essential prerequisite for the development of industries in

> primarily agricultural countries without an industrial tradition and a pool of industrial labor." (1966)

From the perspective of *civic epistemologies*, the importance of expanding knowledge systems and research practices in and for the agricultural sector in less developed countries, can be understood as FAO's attempt to ensure improved scientific practices, which in the developed countries have great cultural significance and influence in policy making. By improving the knowledge systems in the less developed countries, with some regard to their cultural and social experiences, it could be interpreted as FAO's attempt to increase the authoritative power of knowledge in the local setting, which can increase the chances of gaining broad-based support for some of the significant collective choices the individual less-developed countries have/had to make to improve their agricultural output and thus improve food security. This slight awareness of locality and cultural practices is in greater line with the notion of *patchy anthropocene*. This will be further elaborated later within this section.

This emphasis on the importance of research and education within the agricultural sector goes together with the understanding that in effort to solve the world's human hunger problem, an increase in production from the less developed countries is needed. And the production in the developing countries was in this period seen as being hampered "by primitive methods of farming" (1962). With the help to self-help approach to the imaginary of no hunger, it was understood that to achieve this goal:

> "(...) many technical, educational, and economic problems of agricultural development must be solved. Research must be expanded to fill the gaps of our knowledge, hitherto based mainly on agricultural science and experience in temperate zones." (1962)

The notion of research, education, and technological transfer was in this period a result of years of the uneven distribution of agricultural resources and food, both as a commodity and food production, across the developed and less developed countries, as exemplified in the report from 1961:

> "This year's review of the state of food and agriculture again reveals the general pattern which has become familiar during the past decade. There is still an abundance, often a surplus, of agricultural products in the economically more developed half of the world, side by side with continuing malnutrition and even hunger in many of the less developed

countries" (1961)

The uneven distribution is seen as one of the greatest challenges to improve food security across the globale, whereas the notion of knowledge and technology transfer is seen as the one of the biggest facilitators for improvement and solution for this challenge. Within this period the focus on the knowledge and technology transfer led to an increased interest and focus on the specificities of a given nations and/or regions. This is an awareness which first emerged in the previous time period. Fitting with the notion of Tsing's *patchy anthropocene*, increasing their sensitivity and focus to more targeted solutions and transfers to fit the local context and systems, while having a continued focus on improving the administrative and institutionalised systems in the given countries, based on the understanding of the following:

> "Unless these organizational and institutional aspects receive adequate attention, and unless full account is taken of the day-to-day problems of farmers arising from the environment in which they live and work, in spite of all agricultural programing, development is likely to be slow." (1960)

> "New and more productive systems and methods of farming adapted to local conditions need to be worked out and applied in the developing countries." (1962)

Furthemore, the second period and the STI present throughout it is characterised by a shift in the public's awareness of the challenge of hunger, and thus emphasised a change in public values present in the imaginary of the future and how hunger/food insecurity was addressed in this period. The World Food Congress in 1963 helped this change of values along by centering the:

> "world's attention as never before on one of the greatest issues now facing mankind. It declared that the persistence of hunger and malnutrition was unacceptable morally and socially. It emphasized the extent to which the explosive growth of population is multiplying human needs and heightening the urgency of meeting them. It called on all men and women, all governments, and all international and other organizations to take up the challenge of eliminating hunger, within the framework of world-wide development, as a primary task of this generation. At the same time it expressed its conviction that scientific and technological progress now make it possible to free the world from hunger if human and natural resources are mobilized to this end through balanced economic and social development" (1963)

This change of values or public acknowledgement of the hunger problem was even shared by His Holiness Pope Paul VI in the encyclical letter, regarding the development of the people (1967). Further underlining the fact of the world producing a lot of food, but due to the unevenness in distribution, an enormous amount of people, especially in less developed countries, suffered under hunger, malnourishment and food (in)security. Which in the eyes of FAO changed the perspective on hunger, from the production focused 'more is better' STI to increase agricultural output, to a 'help to self-help' perspective and a moral question of flatten out the unevenness of distribution.

To sum up this period, FAO continued their focus from the 'more is better' period into the period of 1959-1969. Though their focus took a turn due to a shift in values in the public in the wake of the World Food Congress and due to food production reaching pre-war levels, now arguing that world hunger is a moral question rather than a question of increasing production. This shift in turn increased FAO's focus on the disparities in distribution of resources and food between the developed and less-developed countries. Moreover, this period showed initial signs of patch and locality sensitivity from FAO, highlighted by the notion of knowledge and technology transfer from the developed regions to the less-developed regions of the world, while arguing that the knowledge systems needed some calibration to the social, cultural and geographical specificities of a given region, to ensure usability of the knowledge produced to improve the agricultural practices and thus the agricultural output. It could be argued that the developing countries, due to the implementation of technology and knowledge transfer cultures and traditions, could become increasingly dependent on the continued supply from the developed countries. This perspective into the practices further established in this period are to some degree contradictory to how FAO imagines the hunger crisis is to be solved, namely through increasing the less-developed countries' self-reliance within agriculture.

5.2.3 The True Green Revolution (1970-1982)

In the period from 1970 to 1982, it can be observed that FAOs STI changed with the challenges of these years. In the beginning of the second development decade the issues at stake were more complex than simply producing any kind of food for an ever-growing population. This increased complexity of problems resulted in a change in the aim and focus area of FAO, as reflected below:

> "(...) assisting countries in their planning for economic development, especially to the five areas of concentration: high yielding priorities, protein, human resources, earning and saving foreign exchange, and war on waste." (1970)

Clearly stated in the above quote, FAO have changed their STI of food security as compared to the 'more is better' mentality predominant in previous periods. The change is truly highlighted in the new five areas of concentration; the solution to food insecurity now relates to producing the right food, which has to go to the right place, for the right price. It was no longer enough to spread modern technological agricultural practices and machinery to the less developed countries and regions. Social Programs (related to the area of human resources) and infrastructural changes (related to e.g. war on waste) were necessary to maintain the stable increases in food production that had been happening in the past, thanks to the advancements in high yielding cereals.

This technology transfer reflected above was part of the Green Revolution, which refers to a period of agricultural advancements and technological innovations that took place primarily between the 1940s and the 1970s. It involved the development and adoption of high-yielding crop varieties, improved agricultural techniques, and the use of modern inputs such as synthetic fertilisers and pesticides. This emphasis on fertiliser is an integral part of how FAO intends to achieve its STI; more fertiliser equals more food. This development is clearly visible when using BERT to visualise the similarity of contexts of the word 'fertilizer' as shown below in figure 10.

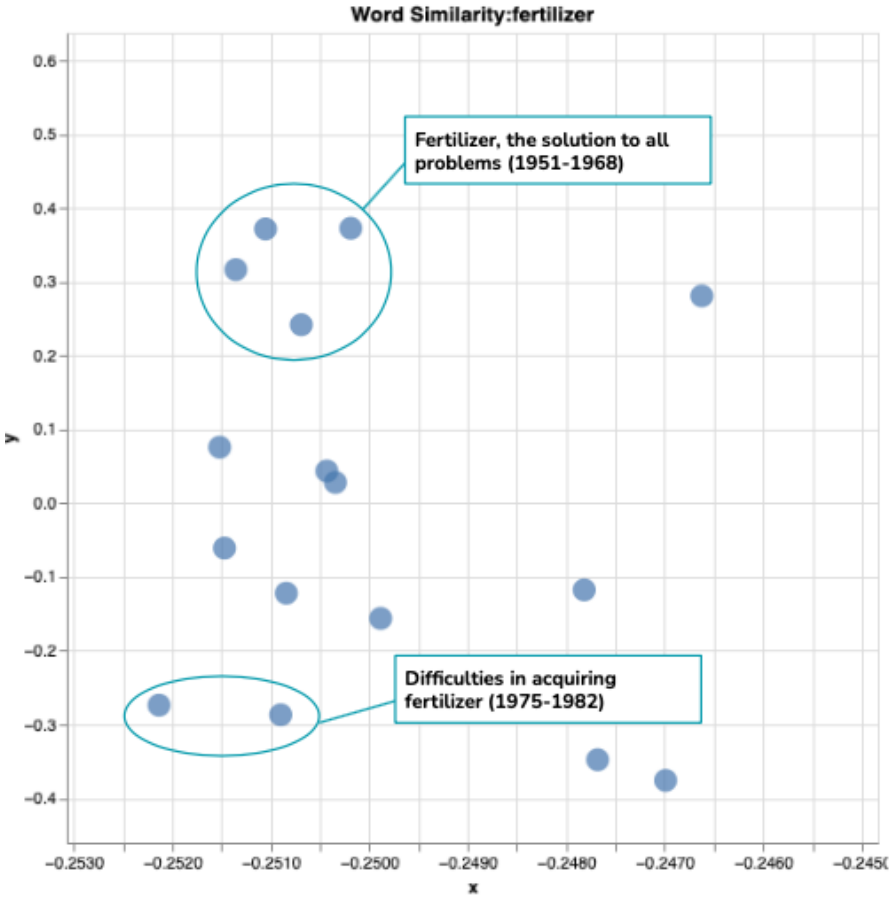

Figure 10: BERT modelling of 'fertilizer' in the FAO reports

The Green Revolution aimed at increasing agricultural productivity, particularly in developing countries, to address issues of hunger and food scarcity. It was driven by the efforts of scientists, policymakers, and organisations to introduce new farming practices and crop varieties that could significantly boost crop yields. Though great alignment between the aim of The Green Revolution and FAO, FAO argued to maintain a certain degree of scepticism:

> "Many people speak of the green revolution as if it were already an accomplished fact. But some caution is called for if we are not to be carried away by mere slogans and catch words." (1971)

This scepticism was based upon the emergence of some of the issues associated with the technology and knowledge transfer from the developed countries to the developing countries within this period. Due to the main idea of the Green Revolution; to continue the agricultural success of the Marshall Plan, which was created with an outset in an European setting, thus spread it to developing countries such as Africa, Asia and South America. The issues that

emerged and that FAO focused upon, was related to the systems needed to spread these innovations, as many of the targeted regions lacked the required infrastructure, education and resources needed for the increased reliance on chemical fertilisers and pesticides that came with the high-yielding crops. These types of issues are a clear picture of a lacking understanding of the importance of locality and specifics of patches, from a *patchy anthropocene* perspective, both from FAO and in the Green Revolution initiatives.

Additionally, this period was heavily influenced by the economic crisis of the developed countries, inflation and a global oil crisis. Due to the oil crisis, the chemical fertilisers which are made from derivatives of oil, led to a reduction in availability and affordability. The increase of production cost of the chemical fertilisers was passed on to consumers, namely farmers, in the form of higher prices. This development made fertilisers, being a vital tool to improve agricultural output, exacerbate the economic pressure of small scale farmers in the developed countries and in particular farmers from the less developed regions. Furthermore, the crisis resulted in supply chain disruptions materialising as shortages of fertilisers on the market:

> ”The shortage and high price of chemical fertilizers show no sign of abating for some time to come. Some important pesticides are running short, and this may soon become a serious problem period and number of developing countries face shortages of fuel and power for irrigation pumping and other essential agricultural purposes.” (1974)

These societal changes and volatilities brought about a change in FAO’s perception of fertilisers, going from being an incremental part of the solution of food insecurity, to becoming part of the problem. This change is illustrated quite clearly in figure 10 where in the years 1975 and 1982 ‘fertilizer’ is mentioned as something that is hard to acquire for the less developed countries and regions, which then leads to years with bad harvests, due to the high-yielding crops, being less tolerant to disease and needing more fertilisers, than the traditional crops, which in turn resulted in further economic instability. As shown by the statement below:

> “The high yields in developed countries and the rapid increases sought in developing countries are heavily dependent, with existing technologies, on the expanded use of energy intensive inputs such as chemical fertilizers, machinery, irrigation and pesticides. “ (1976)

This adverse effect of what was previously deemed as being part of the solution to ending world hunger, but now was part of the problem, can be understood through the lens of the *patchy anthrocene*. Because, as Tsing writes, it is "a conceptual tool for noticing landscape structure, with special attention to what we call 'modular simplifications' and 'feral proliferations'" (Tsing et al., 2019, p. 186). By identifying and tracing the relation between these reveals insight into how and why these landscapes are so prolific and treacherous. So, in the context of FAO, food (in)security, and the emerging issue of fertilisers and pesticides within this period, the chemicals can be seen as the *modular simplification*, whereas the adverse effects can be seen as *feral proliferations*. Developing countries had become increasingly dependent on these chemicals in their agricultural practices but due to factors such as the economic and the oil crises, and the consequences hereof, they were unable to acquire these. And once farmers had to do without, it showed that crops were now less resilient and increasingly susceptible to insects, diseases, and weather conditions, leaving the farmers in a worse predicament than they were before the dependency on chemicals. Thus, reflecting the interrelatedness of, and how the multi-dimensional, more-than-human, historical, economic, and ecological factors may affect such a landscape. This is a clear reflection of how complex the issue of addressing food (in)security can be, and it stresses the importance of exploring the effects on individual 'patches' more site-specifically rather than on a more grand, superficial (or Western), planetary scale.

Furthermore, the economic crisis, as mentioned, also influenced the tendencies of this period. The economic crisis of this period led to a significant shift towards protectionist policies in various countries, driven by a range of economic and political factors; this tendency had been on the rise previously, but now it was a clear part of many developed countries export/import policies, due to the unfolding recession. Protectionism refers to the economic policies and practices of shielding domestic industries from foreign competition by imposing restrictions on imports or providing support and advantages to domestic producers. Thus, by further following the notion of the *patchy anthropocene*, these policies were an attempt to protect individual 'patches' instead of a greater, common 'patch'. In other words, it could be seen as an anthropocentric attempt to ensure that human starvation stayed on the other side of the nation's border, using the tools within the capitalist toolbox. This protectionistic development, was of great concern to FAO, stating that:

> "Supplies and prices of fertilizer have eased, but many developing countries, especially the poorest, have faced great difficulties in obtaining their requirements. Their agricultural export earnings of the developing countries fall far short of their requirements; they continue to be plagued by instability and inhibited by protectionism in developed countries." (1976)

FAO argued that the impact of the combination of a less developed world, now dependent on more advanced technology, e.g. pesticides and chemical fertilisers from the knowledge and technology transfer, and the increasing protectionism in the developed regions, led to increasing disparities, rather than the opposite. Hence, the external crisis, economical crisis, and the oil crisis, heavily influenced the STI, and the way to achieve it, within this period. This transpired into a greater focus on global agricultural cooperation: "(...) in the world of today, agricultural policies can no longer be formulated in an exclusively national or even regional or sub regional context." (1971). Thus, it is argued that the tendency of protectionism which emerged as a response to the oil and economic crises, can be seen as being a form of resistance to the notion of global cooperation encompassed in the STI held by FAO within this time period.

Another issue that started to appear in these years was environmental degradation. This issue was of special interest to FAO, resulting in a section of their annual flagship report being dedicated to dealing:

> "(...) with the major aspect of the environmental problem, namely the pollution of the world's rivers, lakes and seas, and its effect on aquatic living resources and on fishery and its products. This is a problem of increasing concern to all countries, both industrialized and developing." (1971)

This added yet another layer to the increasingly complex situation of food security, as now not only the present or the coming years were at stake, now the future generations' access to food was perceived as threatened. To make matters worse, the threat came partly from the solutions to improve the present food security, which increased pollution. This development not only took the spotlight in FAO but also in the UN, which led to the Conference of Human Environment in 1972, which:

> "(...) represented an important step in the conscious recognition by mankind of its responsibility for the welfare of the future generations that will inhabit this small planet. Among the resources of the planet, none are more important than the plants and animals that provide man with his food." (1972)

In sum, this period faced a rapidly increasing world population, stagnating food production, a drop in foreign aid, two oil crises, and a global recession. Overall, the period from 1970 to 1982 marked a critical phase in the evolution of agricultural development and food security. The STI held by FAO faced challenges and resistance regarding technology transfer, protectionist policies, environmental degradation, and the complex interplay between short-term solutions and long-term durability. These issues highlighted the need for a more comprehensive and globally cooperative approach to address the challenges of food security and environmental degradation in the context of the evolving patchy anthropocene. This new and increased focus on the environment and future generations emerged in the late years of this period, and continued to become a more prominent topic throughout the periods ahead, which will be explored further in the following sections.

5.2.4 Our Common Future (1983-1999)

The period outlined within this section spans from 1983 and 1999 and is a period characterised by a more globalised world in light of the Fall of the Berlin Wall, the information age, and an increased awareness surrounding the environment and human's impact on this. This rising concern and attention to the environmental impact that humans inflict on ecosystems, particularly the agri-food sector, reflects a newfound focus on sustainability, the future planet, and future generations which started to emerge in the late years of the prior period.

FAO writes in their 1993 report that their renewed focus revolves around "food insecurity, poverty and environmental degradation, to name a few." (1993). As demonstrated in previous sections, fighting poverty is an incremental part of eradicating world hunger, so while this notion persists, it is interesting to note that 'food insecurity' and 'environmental degradation' are two new introductions. 'Food insecurity' is first mentioned in the 1991 report where FAO writes that "food insecurity in many low-income countries is essentially a manifestation of the

problems of inadequate access to supplies by the poorer population groups." (1991). To better understand the emergence of this new term, BERT modelling has been applied:

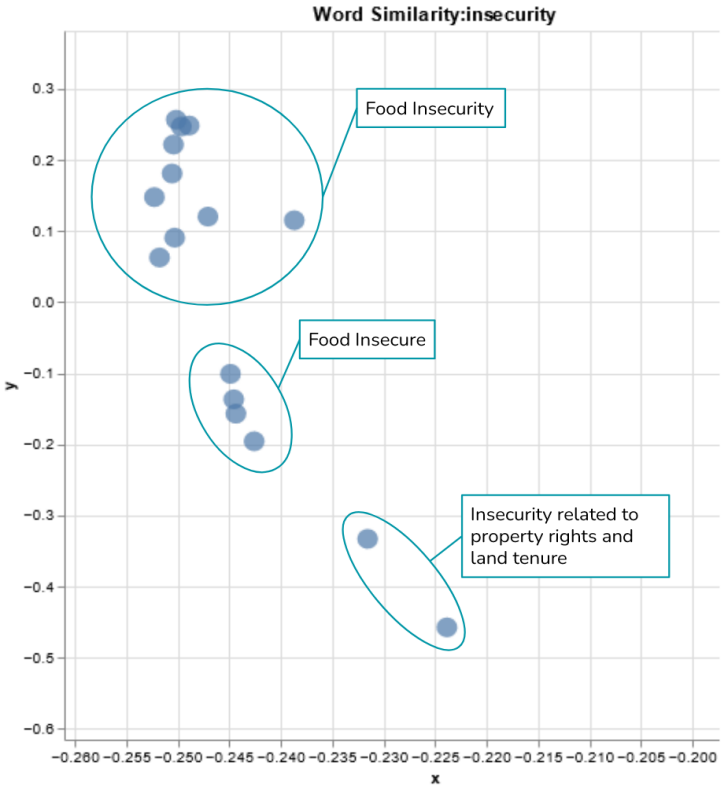

Figure 11: BERT modelling of 'insecurity' in the FAO reports

Because the code within BERT is not designed to run two words such as 'food insecurity', the word 'insecurity' was run through the script. Therefore, through a qualitative exploration of the graph, the instances in which 'insecurity' has been used in the context of 'food insecurity' has been identified and annotated on figure 11. It was found that there were 16 instances in total, 14 of them being in the context of food insecurity. Within this frame, nine instances were used in the time from 1991-1999, while five instances were used between 2000-2016. This clearly reflects that the term food insecurity was a new one emerging within this period, and due to the nature of the word, it reflects a more encompassing and complex view on hunger. The U.S. Department of Health and Human Services defines 'food insecurity' as "a household-level economic and social condition of limited or uncertain access to adequate food" (U.S. Department of Health and Human Services, n.d.), meaning it is not exclusively about the lack of food, but also about the social and economic factors that play into the lack of access to food. It is argued that this way of addressing world hunger can be seen as a shift in the STI present within FAO. While social and economic factors have been a focus for FAO

when navigating the issue of global hunger throughout previous periods, it has now been solidified in a new and encompassing term.

This is further reflected with the use of 'environmental degradation', as FAO describes to be one of their key focuses within this period. While the environment has been grounds for concern in previous periods, this is the first instance in which the environment is part of the top priorities and outlined so specifically. The significance of the environment within this period is exemplified through the emergence of the term 'Sustainable Development'. Within the reports, the term appears first in the 1987/88 report where it is defined as "a mode of development that improves human welfare without damaging or ultimately destroying the environmental base on which man's life system depends." (1987/88). The introduction of this term clearly reflects the increased societal awareness surrounding the environment and human impact on ecosystems as well as its impacts on agricultural food systems. This emergence can be seen as the result of the information age, resulting in enhanced information spreading, and the release of the report called 'Our Common Future', or more commonly known as the Brundtland report, in 1987. The Brundtland report outlined that "critical global environmental problems were primarily the result of the enormous poverty of the South and the non-sustainable patterns of consumption and production in the North." (ARE, n.d.), and urged for future strategies uniting development and the environment, thus 'sustainable development'.

FAO noted in their 1987/88 report that "a consensus has slowly evolved a greater concern for the environment" and that it had "mobilized public concern" (1987/88). How this increase in environmental societal awareness may have affected the way in which FAO, thus the STI held within it, navigate the issue of global hunger, is reflected below:

> "FAO is addressing this issue, first to evolve a comprehensive set of policies and second, to move toward evolving operational guidelines there's a guide to member countries." (1987/88)

> "(...) seeks to make the concept operational." (1989)

> "(...) there is the need for greater integration of economic and environmental considerations. All too frequently, the costs of environmental degradation are inadequately accounted for when formulating development strategies, policies, programmes and projects." (1989)

Hence, FAO dedicated much attention to the enhanced focus on environmental degradation in terms of policy measures, programmes, and projects. This is exemplified well in the 1985 report which outlines a new measure regarding the use of pesticides. In 1985 FAO adopted the International Code of Conduct on the Distribution and Use of Pesticides. As opposed to previous periods where there was a general consensus that more pesticides equaled 'good', now in this period, rules and regulations for the usage of it due to its impact on the environment were implemented. It is argued that this can be seen as a materialisation of the STI held within FAO as a result of the enhanced awareness surrounding the environment and human impact on it, as well as more consideration regarding future generations.

To further understand the impact of the public's increased attention and concern to sustainable development and the environment, and how this may have influenced the way in which FAO attempts to address this, it is useful to apply *civic epistemologies*. CE stresses the importance of including multiple perspectives, values, and expertises in decision-making processes, especially when they involve complex global challenges such as climate change. This is reflected in the increased public awareness in the 80's regarding issues such as pollution, deforestation, and loss of biodiversity. This public awareness was intensified by various actors including scientific researchers, the media, grassroots and environmental organisations. Which FAO can be seen as trying to accommodate by responding to the public's concerns regarding the negative changes in the environment through "(...) a comprehensive set of policies and second, to move toward evolving operational guidelines (...)" (1987/88), and "(...) development strategies, policies, programmes and projects." (1989). Moreover, this reflects how scientific and technical knowledge is shaped by social and political factors, and oppositely, how it shapes social and political life. Thus, the public (and scientists, politicians, social rights movements, etc.) is part of the creation of these policies initiated by FAO, which ultimately makes these policies, strategies, programmes, operational guidelines, etc., a product of co-production. However, a point made by Jasanoff might put a stick in the wheel. Because she argues that if governance is to be more inclusive and participatory, then the establishment of new forms of accountability that enable citizens to hold decision-makers accountable for their actions are needed (Jasanoff, 2005, pp. 261–262). This is not present within the reports anywhere, thus FAO, at least from the perspective ascertained through the reports, does not help establish a fully inclusive and participatory approach to governance, either for themselves or for member countries.

Although, there is also a dichotomy present within the debate surrounding the environment. FAO iterates that while the environment should be a considerable factor when outlining current and future agricultural strategies, so as to not impede future generations, some nations may not have the means to adjust to more sustainable approaches:

> "(...) rural areas, where poverty and the lack of alternative employment opportunities may force them to over exploit the natural resources on which they depend." (1989)

Hence, reflecting a more complex and multifaceted dilemma in terms of eradicating hunger, while accommodating concerns regarding environmental sustainability, in an increasingly globalised and interconnected world. How this further translates into the STI present within FAO will be explored in the following periods. Because as we see in this period, globalisation is truly starting to kick off, people, and the challenges of the world, are more connected than ever. And while this can bring positive forces, FAO iterates some of their issues and concerns in light of the information age:

> "Although ours is an 'information age', food insecurity tends to attract media coverage only when exceptional events bring to light some of its most dramatic manifestations." (1995)

> "(...) the idea of "food security first" still has to gain universal recognition, not only as a moral principle but as a matter of interest to all." (1996)

> "(...) in this era of increasingly globalized influences and interest, generosity becomes self-serving in its ultimate effects." (1996)

Here it can be observed that FAO problematizes the issue of food insecurity regarding how it is perceived by the international community. It is not a focal point unless something extraordinary happens, and while appealing to the moral responsibilities regarding food security, they reiterate the persistent problem of self-serving interests among nations. Here, it is interesting to look through the lens of the *patchy anthropocene*. As observed in previous periods, FAO (in the spirit of the UN), holds and tries to extend a STI concerned with a unified world. However, as a contrast and a form of resistance to this STI, nations have demonstrated protectionist and self-serving policies to protect their own 'patch'. Nations exist in their own little 'patches' with different ecological, social, political, and economic forces affecting their values, concerns, and motivations. Meaning that nations ultimately, are being

locally affected in their prioritizations of "food security first" as well. This is further exacerbated by increasing globalisation, resulting in a more intertwinedness between patches, making them prone to external factors, ranging from access to international markets, climate change, and hostilities, affecting their political and social prioritisation of issues. An example of external factors influencing a patch is the 9/11 attacks, which changed how the West, especially North America, saw themselves as part of the world. This change and its possible influence on prioritisation, resulted in FAO attempting to remind the world that their STI of working together as a unified world as the only possible solution to the complex problems humankind faces, as reflected below:

> "It is hoped they have strengthened our awareness that the future of humanity is truly a shared future and that many of the challenges humanity faces require common solutions." (2002)

However, the only way to achieve the end goal of the STI, the vision held by FAO, is by addressing multiple factors regarding food security, as well as putting it first. Nations only pay attention when it is of a dramatic nature, alas they mind their own 'patch', as highlighted in the quotes above. But to achieve this vision, nations must recognize the interconnectedness between food security and the environment, because if the environment suffers, then all the food systems within the separate patches will suffer. It is not enough to mind your own 'patch' because if some nations do not have the means to change to more sustainable alternatives, they will impact the environment negatively resulting in a worsened climate crisis, which ultimately will affect all the 'patches' collectively. Therefore, nations must look beyond their individual 'patches', abandon protectionist policies, and recognize the interconnectedness between the global environment and its impact on their specific patch in terms of food production, according to FAO exemplified through the quote below:

> "It is hoped they have strengthened our awareness that the future of humanity is truly a shared future and that many of the challenges humanity faces require common solutions." (02)

This dichotomy is inherently in conflict with the STI held within FAO, although it also presents the opportunity to assess as to how FAO navigated this challenge. To achieve their vision of a future with no hunger, nations have to deal with issues related to climate change and the environment. This resulted in FAO facilitating the first World Food Summit in Rome

in 1996 because “the time has come for global mobilization to address the biggest problem of today's world: hunger and food insecurity.” (1995). The goal was to make a plan of action, “a realistic and necessary guide for defining and implementing food related policies at the national and international levels.” (1997) Here, it can be observed how FAO intends to achieve their future vision, the end goal, by utilising their political power as a supranational institution to create a forum and platform as a stepping stone for their STI to extend itself across geographical spaces. As a contrast to previous periods when technology and agricultural advancements were a focal point in order to achieve the imaginary, it is now much more focused on appealing to the international community; to implement policies on a supranational, national and regional level and appeal to all the individual patches by stressing the interconnectedness amongst them. In other words, the STI held within FAO manifests as a guide for defining and implementing food related policies at a national and international level.

In conclusion the period of ‘our common future’ is a period heavily influenced by climate change, and increasing public awareness hereof, thus the STI of FAO evolved to include a more specific futuristic outlook, namely the future of the planet in combination with ensuring food security for future generations. Furthermore, this period brought about the introduction of the term ‘food insecurity’ whereas up until this point the lack of food had been referred to in the terms of ‘hunger’ and ‘malnutrition’. Thereby, encompassing a very concrete understanding of food items per person to end world hunger, while the new terminology was created to also encompass societal factors, such as poverty and employment, into the understanding of food and the lack thereof. Moreover, due to the resistance inherent in separate nations’ due their focus on their own ‘patch’ in their current state and situation, FAO attempted to utilise their political power as an international organisation to create a stepping stone for their STI to extend to these local patches through the conference on the World Food Summit. This attention to the future and the impact of human action on the environment was an evolution of the STI which continued throughout the following periods.

5.2.5 Technology of the Future (2000-2009)

The period outlined within this section spans from 2000 to 2009 and is a period heavily characterised by a future oriented outlook on the world in terms of food security as well as the technology required to solve this challenge. It is also a period where the information age and

globalisation truly gets momentum, and with all the good it has brought, it addresses the more adverse consequences of an increasingly interconnected world as well.

Starting at the beginning of a new century, the world's leaders gathered in 2000 at the Millenium Summit to discuss the future of the world in the new millenia, and to reaffirm their commitment to the UN charter. As a result, the Millenium Declaration was formulated which contained a set of global development goals (Millenium Development Goals) for the 20th century; the first goal being "1. Eradicate extreme hunger and poverty" (United Nations, n.d.-e) (REF). This aligns with the STI embedded in FAO, with food security being the number one priority, and still perceived to be achievable through technological advances in agriculture. In this period, one of these technological advances was the so-called 'gene revolution' which is the period following the 'green revolution' where biotechnology and GMO showed great promise and became more prevalent in agricultural practices. However, with these new technologies, a greater focus on future implications were central as reflected within the reports of this period. In the 2000 report, FAO writes that much progress has been made over the past decades, particularly in terms of improving living conditions and opportunities worldwide, however we "must pose serious questions about the meaning and scope of our economic and technological achievements and their cost to us and future generations." (2000).

So, as compared to the previously outlined periods, there is a greater sense of caution in regards to new technology. This is further reflected in the debate surrounding the emerging biotechnology which FAO believed to be a potential solution in solving the current and future global food crisis. They wrote that "(...) development of new and safe biotechnologies can greatly enhance the prospects for sustainability improving agricultural productivity today and in the future." (2003/04). It is interesting to note the difference in the way they address this cutting edge technology as opposed to previous periods. Now, there is emphasis on the technologies being 'safe' and 'sustainable'. This can be seen as an evolution, or adjustment, of FAO's STI where advancements in agricultural technology is still the way to achieve this future vision of eradicating global hunger. Albeit the focus is much more long-term and much more encompassing in the sense that it considers future implications regarding factors other than agriculture. This is further exemplified in the highlighted quotes below:

> "(...) well aware of the potential environmental and food safety risk posed by certain aspects of biotechnology, particularly genetically modified organisms (GMOs)." (2003/04)

> "(...) importance of harmonising regulations related to the testing and releasing of GMOs." (2003/04)

> "There is strong consensus among scientists concerning the need for a case-by-case evaluation that considers the potential benefits and risks of individual GMOs compared with alternative technologies." (2003/04)

This rather cautious and future oriented mindset from FAO stands in stark contrast to their attitude towards technology during 'the green revolution' where the views were much more characterised by a 'dive in head first' approach or the 'more is better' mentality. It is argued that this is a clear indication of a change in societal attitude towards technology, thus the STI within FAO is being co-created and shaped by this.

To further underline this shift of societal attitude, values, and concerns, BERT modelling has been used to examine the contextual settings of the word "safe" and "sustainable".

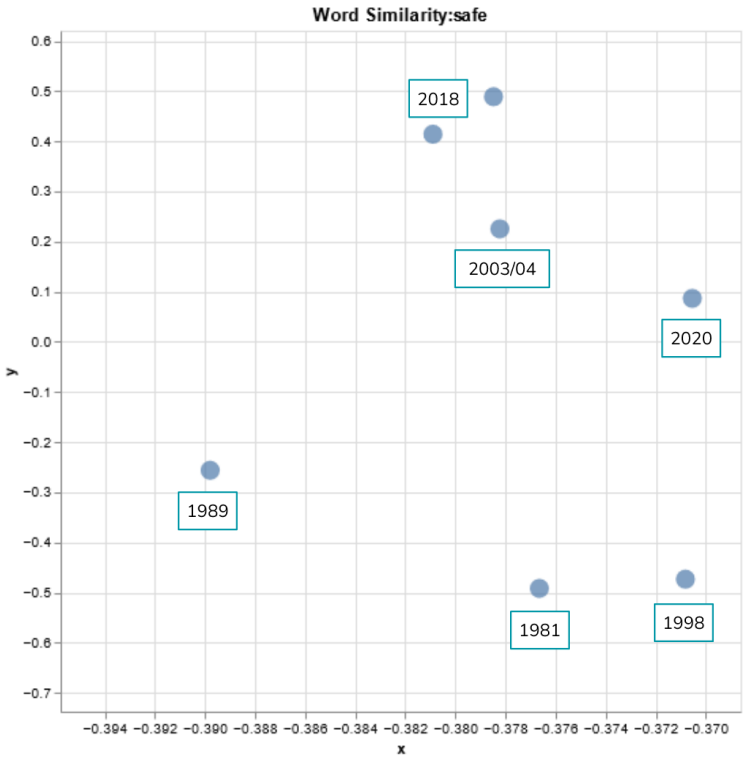

Figure 12: BERT modelling of 'safe' in the FAO reports

As seen on figure 12, the term ‘safe’ has been used on seven instances since 1947. They are relatively spread out, meaning they differ in which context they were used. The first mention was in 1981 where it was used in the context of minimum safe levels of world food security. In 1989 it was mentioned in the context of minimum safe levels of cereal stocks. In 1998 it was used in the context of safe levels of global food stocks. And in 2003/04 it was used in the context of safe biotechnology. So, up until this point the word ‘safe’ has been in relation to safe quantities of food, whereas in the 2003/04 report it is in relation to the safety of a new technology. While the 2018 and 2020 reports are not included in this period, for curiosity's sake, it is observed that ‘safe’ is used in the context of safe drinking water and safe migration, respectively. However, the BERT model as seen above reveals a clear transition from a focus on quantities (more is better) to a greater focus on the safety of certain technologies or other phenomena, thus underlining the shift in STI. The collectively held vision of the future is no longer centred around the quantity of food but rather the quality, or safety, of it.

The shift is further reflected when examining the term ‘sustainable’:

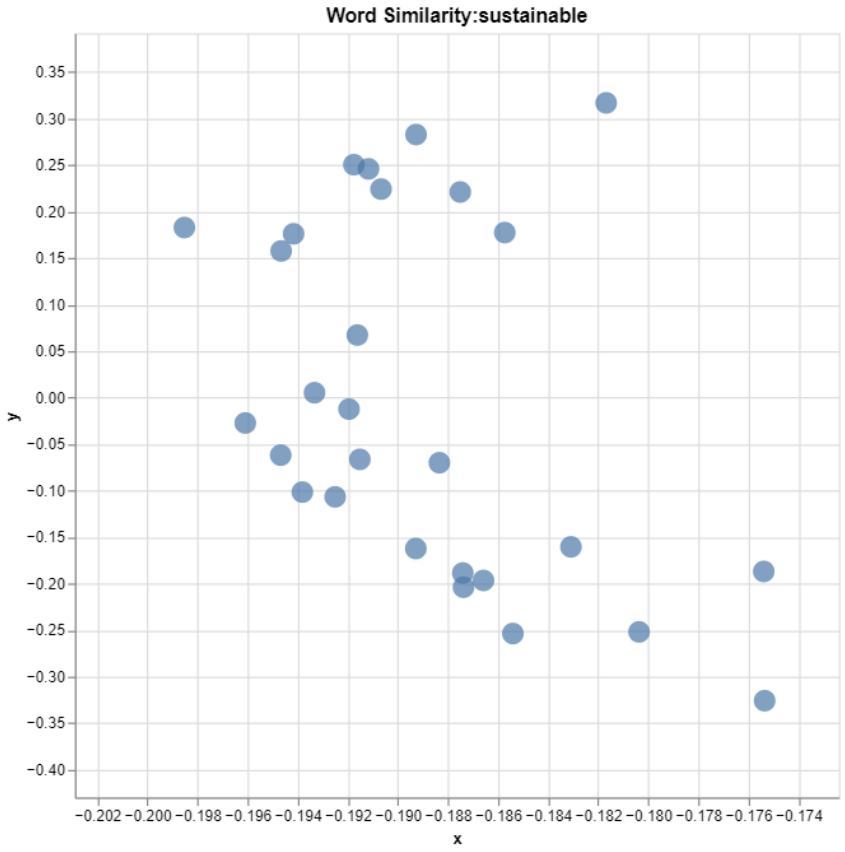

Figure 13: BERT modelling of ‘sustainable’ in the FAO reports

As seen above, the term 'sustainable' is used more frequently than the term 'safe'. There are 28 instances and the contexts surrounding the term varies a great deal, however the interesting thing is that only three of those instances predate the year 2000. Meaning, there has been a remarkable upsurge of the use since 2000. Since the word 'sustainable' implies that something will last, be upheld, or be maintained; something that will sustain long enough that it transcends into the future, this underlines the point that within this whole period, there is a shift of STI that is much more future oriented in terms of safe and sustainable agricultural developments and technologies.

The future oriented perspective further presents itself in relation to the livestock industry. In the 2009 report the livestock is mentioned for the first time with regards to its environmental impact. Within the previous periods it has solely been a means to provide more food, however in this period there is a focus on its current and future impacts. FAO writes:

> "The rapid transition of the livestock sector has been taking place in an institutional void. The speed of change has often significantly outpaced the capacity of governments and societies to provide the necessary policy and regulatory framework to ensure an appropriate balance between the provision of private and public goods. A number of issues are confronting the sector: There is increasing pressure on ecosystems and natural resources - land, water and biodiversity. The livestock sector is only one of many sectors and human activities contributing to the pressure. In some cases its impact on ecosystems is out of proportion with the economic significance of the sector." (2009)

It becomes apparent that the livestock sector is raising great concerns in relation to its environmental impact, however the main finding is that it emphasises the concern for the longevity of the planet and all its systems as well as the future impacts of agricultural technologies.

To further understand this shift, it is useful to apply the concept of *civic epistemologies*, because CEs refer to the culturally specific ways in which the public expects the state to enact and implement expertise, knowledge, and reasoning in terms of decision-making. The way in which FAO acts in relation to biotechnology can be seen as a method in which they accommodate the expectations that the public may have from them:

> "(...) assured the international community that, through holistic and multidisciplinary scientific approaches of risk evaluation, including risk assessment, risk management and

> risk communication, FAO will continue to address all issues of concern to its constituents regarding biotechnology and its effects on human, plant and animal health." (2003/04)

> "FAO will continue to provide member countries with objective commerce science based information analysis regarding biotechnology and its application in crops, livestock, fisheries and forestry." (2003/04)

As exemplified above, the relation between science, technology, and democracy, and its influence in the decision-making process within an institutional setting becomes apparent. It was observed in the 2000 report that due to the World Food Summit, an increased awareness surrounding the complex challenges facing agriculture and global food security spread amongst the public within the international community. Societies, the public, expect the democratically elected governments to act with the public's best in mind. And with FAO being an extension of the UN, thus a representative of many democratically elected nations, they act on behalf of the public. For FAO to have any sort of authority in order to reach the collectively held vision of the future, that is to eradicate hunger, they must be perceived as legitimate. This is argued to be done through the comprehensive and cautious measures regarding GMO described in the highlighted quotes above with a strong focus on trials, tests, and regulations based on scientific knowledge. It is a clear reflection of how FAO implements expertise and scientific knowledge to back up their initiatives to eradicate hunger.

Furthermore, another dominant aspect influencing this period is that of globalisation and the continuation of the information age. FAO writes that "Observers of our time have termed it variously an information, atomic and globalization age. It can also be characterized, sadly, as an age of inequity." (2000). Particularly, the issue of disparities and inequalities continue to persist throughout all periods, however with globalisation and a broadened view on the world, the issue seems amplified. As reflected in the quote below, an aspect of FAO's STI becomes very apparent:

> "(...) a world in which disparities and inequities are as striking as they are unjustified - a world in which the poorest 20% of the population accounts for slightly more than 1% of global income, while the richest 20% claims 86%. We also find it hard to conceive of safe and civilized future societies in which such disparities would be allowed to widen further (...)" (2000)

Here, the future oriented perspective continues as well as the increased focus surrounding the notion of 'safe'. It is observed that there is a particular future vision of a safe and civilised society, although this cannot be achieved with the current disparities and inequalities present around the world. FAO iterates in their reports that there are many upsides to globalisation, e.g. the globalisation of food systems resulting in an increased flow of technology, capital, people and goods, including live animals and products of animal origin, around the world (2009). However, there is also a significant focus and concern for the more negative consequences such as the exacerbation of inequalities.

> "There are powerful forces behind the trend of growing inequality. The ongoing process of globalization and market liberalization may unleash opportunities for all, but more so for those who have the resources, information and expertise to benefit from them." (2000)

Here, it is indicated that certain globalisation processes such as the liberalisation of international markets put the developing countries in disadvantaged positions, and due to the nature of it, it is the developed countries who benefit the most from this.

Another concern for FAO is the effects of globalisation in terms of numerous plant pests and animal diseases, and their impact on agricultural systems, which are now able to spread much more freely across borders (2002). While the developed world has the means to combat these globalisation-caused effects, the developing countries may not have the same resources, thus increasing the inequalities that prevent the future vision promoted by FAO to come to realisation. Interestingly, the solution to this problem, according to FAO, is where we observe another shift in regards to the STI.

During previous periods, the STI in FAO was characterised by a notion of eradicating world hunger, and this was achieved through technological agricultural advancements. However, within this period it is observed that FAO suggests that it is no longer purely technology that will solve the problem, but rather governments and institutions play an equally big role in this:

> "The state of Food and Agriculture 2000 advocates ways out of the poverty trap in which governments and institutional structures play a major role. It is fundamental that the public sector does not relinquish its role as a provider of basic social services and does not neglect the poor and vulnerable, and it is crucial that it creates an institutional framework that unleashes and protects the people's initiative and rewards their efforts." (2000).

This is a major shift in the way FAO views the way in which the hunger crisis should be solved. Granted, there have previously been appeals to governments to enact the STI present within FAO, however this is the first mention of the role of governments' and institutions' responsibility to such an explicit degree.

Thus, the period from 2000-2009 is one characterised by a future oriented outlook on the world in terms of food security as well as the technology required to solve this challenge. There appears an increased awareness surrounding technology to be safe and sustainable, with much regard to the future implications specifically of agricultural technologies, e.g. biotechnologies. With the use of BERT modelling, the shift of societal attitude, values, and concerns in relation to the STI within FAO was underlined. Further, by using *civic epistemologies* it was argued that due to increased public concerns towards new and emerging technologies, FAO implements expertise and scientific knowledge in an effort to legitimise their initiatives in relation to eradicating world hunger. Lastly, this period was characterised by an ever increasingly globalised world, with all its goods and bads. One of the bads being exacerbated disparities which heavily influenced the STI. However, it is observed that FAO's way of addressing this issue is no longer through purely technological advancements, but also with a strong emphasis on the responsibilities of governments and institutions. Arguably, with the speed in which the world is becoming more globalised and interconnected, the challenges regarding food security are becoming more complex and intertwined. Thus, the transition to the next section has been made here.

5.2.6 Sustainable Development (2010-2021)

In the following section, you will be introduced to the temporal trends that influenced FAO's perspective on how to achieve the imaginary of zero hunger in the world during the years of 2010-2021. It is a period heavily influenced by the continued focus on future technology from the period prior, with an increasing focus on sustainability in all areas of society, which materialised in the UN's SDG's from 2015. Furthermore, it is a period which highlights just how truly the world and its systems have become intertwined, including the food system that was challenged in a new way due to the implications of the Covid-19 pandemic. This intertwinedness is also a characteristic for the understanding of the problems that the world and we humans face in the form of how climate change affects every aspect of the human and the more than human experience on Earth, from a FAO perspective.

As exemplified throughout all the previous periods the main STI of FAO is to eradicate hunger, though over the years the STI have evolved to encompass a plethora of different aspects. This continued expansion of different elements as part of the solution to end food insecurity coincides with the increasing globalisation; the establishment of increasingly interconnected systems in all sectors of society, the intertwined relationship between food (in)security, poverty, health, environment, and rural development. Which are all further challenged by, and connected to, climate change.

This increased interconnectedness and complexity of the world, and its challenges, is further exemplified through the development of world goals set by the UN. For example, in the period 'The True Green Revolution' spanning from 1970-1982, the key priorities were lined out to be "high-yielding varieties; Filling the protein gap; War on waste; Mobilization of human resources; Earning and saving foreign exchange." (1969). In the period 'Our Common Future' spanning from 1983-1999, the key focuses were outlined to be "food insecurity, poverty and environmental degradation" (1993). And in the 2000-2009 period, the Millenium Goals were formulated and consisted of eight focus areas. Fast forward to today, and the Sustainable Development Goals from 2015 which consists of a whopping 17 different goals, with an understanding that to achieve one of these goals, problems from different areas related to other goals need solving first or simultaneously due to their interconnectedness. Thus, the problem of food insecurity has over time evolved into a nightmare-ish compilation of wicked interrelated problems, forming a monstrous leviathan.

Interestingly, over the years, the State of Food & Agriculture has changed in its structure, and within this time period each report is very centred around specific topics, e.g. women in agriculture, malnourishment, water, migration, and the agri-food system. Even though each report has a main topic, they are all focused on the previously mentioned interconnectedness of how different topics interact and influence sustainability, the climate, and food (in)security. Thus, the reports have changed from providing a general overview focused on the commodities of the agricultural sector, to a report which is a part of the knowledge production on the interconnectedness between the problems facing humans, and how to approach these from a holistic point of view. This holistic approach by FAO, from a *civic epistemology* perspective, shows an increased focus on the democratisation of knowledge. While arguing for a holistic approach, FAO further argues that "there is no size fits all" solution (2018), thus

each solution and intervention need to be undertaken with respect for and attention to local traditions, cultures, and norms that are specific to any given patch, including the disparities within knowledge, materials, and consequences of climate change. Moving closer to the understanding by CE on how to make decisions in a democratic society: in democratic societies, decision-making should be informed by a range of knowledge and expertise, including experiential, practical, and local knowledge. Due to the increased complexity, interconnectedness and yet patchy specificity of the world's problems and thus their solutions, FAO argues that agricultural innovation strategies must:

> "focus not just on increasing yields but also on a more complex set of objectives, including preserving natural resources and raising rural incomes. They must also take into account today's complex policy and institutional environment for agriculture and the more pluralistic set of actors engaged in decision-making. An innovation system that facilitates and coordinates the activities of all stakeholders is essential" (2014)

The focus on the complex policy and institutional environment for agriculture, as stated by FAO in the quote above, is further exemplified in a concentrated attention to the systemics of food security and food insecurity. This increase in attention was helped along by the Covid-19 pandemic, causing increased pressure on the agro-food system which led to the first ever United Nations Food Systems Summit in 2021. This Summit led to an agreement on:

> "innovative solutions and strategies to transform agrifood systems and leverage those changes to deliver progress across all the SDGs. The Summit's call to action focused on five objectives, one of which is building resilience to vulnerabilities, shocks and stresses to ensure the continued functioning of healthy, sustainable agrifood systems."(2021)

As determined and exemplified above, FAO understands the global food systems as interdependent, having global reach while being rooted in patches. This is further underlined by stating that "infrastructure seems to be a key factor that holds back development" in the report from 2017. Moreover, FAO argues for an understanding of the stress or shocks to the food system to have consequences; some global/international, national, and even local. Though before the Covid-19 pandemic, agro-food system stress and shocks primarily consisted of hostilities and weather phenomenon, the ladder being intensified by climate change. In other words, the food system has become increasingly complex in part due to the immense globalisation, and thus prone to unexpected events and stresses, affecting all and

every human in different ways based on their patch. Thus, the STI of FAO, eradicating hunger and poverty, already formed as a leviathan, now includes another aspect: resilience in the agrifood systems based on the principle of diversity. As reflected in the quote below, this has materialised in an appeal to governments to:

> "make resilience in agrifood systems a strategic part of national and global responses to ongoing and future challenges. A guiding principle is diversity – input sources, production mixes, output markets and supply chains – because diversity creates multiple pathways for absorbing shocks." (2021)

In general the period from 2010-2021 continues the line of imaginary from earlier periods, such as the importance of reducing poverty, increasing public health and education to improve food security - a line of imaginary going back to the period called 'give a man a fish' in this thesis. Furthermore, a continuation of a focus on the importance of locality when creating knowledge and implementing interventions and innovations. Attention to locality or patches have only increased over time, and in the period of 'sustainable development' the notion of "there is no "one-size-fits-all" approach" (2020) is incremental. FAO argues that "different countries - and even different regions within countries - have different characteristics and face different challenges" (2020) which should be taken into consideration to ensure sustainable change and innovation. Moving closer to a *patchy anthropocene* approach and understanding, this move is done through the adaptation of a territorial approach for any initiative FAO undertakes: "the solutions proposed (...) are consistent with the territorial approaches adopted by FAO's Hand-in-Hand Initiative to target problems and challenges at the territorial subnational level." (2020).

Moreover, a focus on women in agriculture highlighted in the report from 2010/11 and 2015, where FAO argues that the improvement of women's working conditions within agriculture and improvement of their access to materials to the same level as their male counterparts, thus closing the gender gap in agriculture, food production outputs in developing countries could be improved with:

> "between 2.5 and 4 percent. Increasing production by this amount could reduce the number of undernourished people in the world in the order of 12–17 percent. According to FAO's latest estimates, 925 million people are currently undernourished. Closing the

> gender gap in agricultural yields could bring that number down by as much as 100–150 million people." (2010/11)

Thus, the STI of FAO in this current period carries the hope of changes in how the social order is structured, due to women facing "gender-specific constraints" (2010/11). Increasing the focus on women's struggles in the world of agriculture, due to their potential to "make crucial contributions in agriculture and rural enterprises in all developing country regions, as farmers, workers and entrepreneurs." (2010/11) will in turn, according to FAO, improve "agricultural production, economic growth and the well-being of their families, communities and countries" (2010/11). By investigating the increased focus of inclusivity and gender-sensitivity in FAO and their STI in BERT (see figure 14), we found that the similarity of contexts that the word 'women' is being used in is fairly similar. This could be due to the notion of women in agriculture being primarily present in the reports from 2013 and forward. The report from 2013 being especially dedicated to the topic, which explains the frequency of nodes extracted from this report and those that comes after.

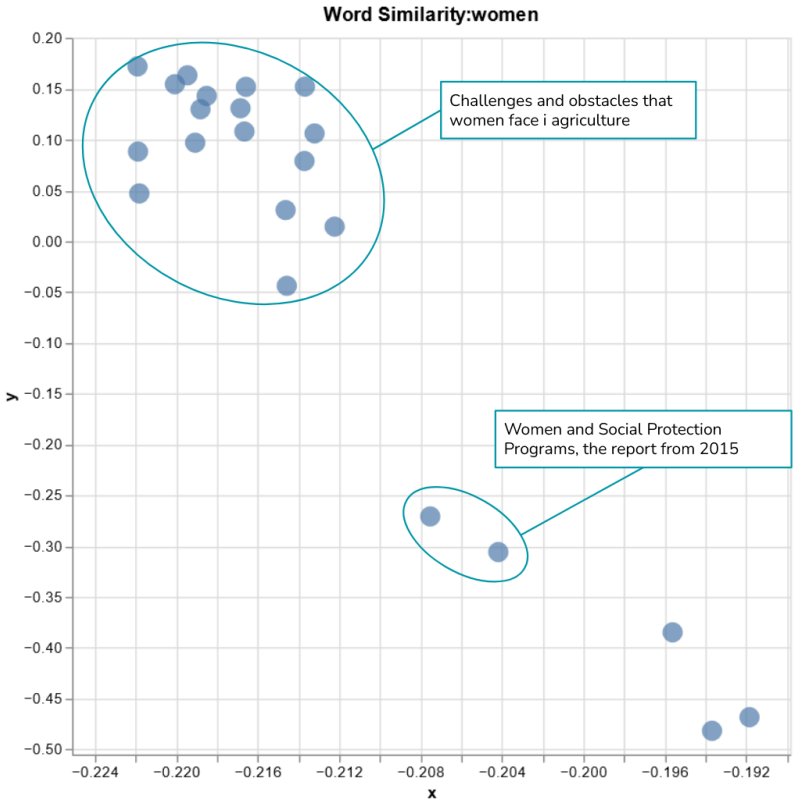

Figure 14: BERT modelling of 'women' in FAO reports

As seen in the top left corner in coordinate system a semi tightly knitted cluster have formed, this cluster is concerned with the challenges and obstacles that women faces in agriculture, shortly mentioned earlier, such as:

> "Women control less land than men and the land they control is often of poorer quality and their tenure is insecure. Women own fewer of the working animals needed in farming. They also frequently do not control the income from the typically small animals they manage. Women farmers are less likely than men to use modern inputs such as improved seeds, fertilizers, pest control measures and mechanical tools." (2010/11)

The two nodes in the middle of figure 14 are from the report from 2015, this report is concerned with Social Protection Programs, and the value they can add in regards to improving food security. Social Protection Programs overall aim at improving people's well-being, by implementing policies and programs that help prevent, manage, and overcome e.g poverty. FAO further argues that:

> "Programmes targeted at women have stronger food security and nutrition impacts. Programmes that are gender- sensitive, reduce women's time constraints and strengthen their control over income enhance maternal and child welfare. This is especially important because maternal and child malnutrition perpetuate poverty from generation to generation". (2015)

Once again showing as a reflection of how complex, encompassing, inclusive, and multifaceted the nature of the STI has become compared to the more simplistic versions from earlier periods.

Another noteworthy aspect within the period of 2010-2021 and the associated STI is that it is also heavily influenced by climate change, due to the consequences of climate change being a main challenge in increasing and supporting food security world wide. FAO argues that:

> "The world faces an unprecedented double challenge: to eradicate hunger and poverty and to stabilize the global climate before it is too late. (...) But meeting the goals (...), while addressing the threat of climate change, will require a profound transformation of food and agriculture systems worldwide" (2016)

FAO's vision to achieve this profound transformation is tied to the notion of modern present and future technology, a continuation of the STI present in the period prior. The

transformation and implementation of new technological innovations must be done in a fashion that does not jeopardise the already established capacity of the agricultural sector and system. The focus on technology and innovation as part of the solution to food insecurity and as part of the STI of FAO can be traced back to the periods called 'More is Better' and 'Give a Man a Fish' - where knowledge and technology transfer increases in research practices tied to the specifics of the patches in question. As a continuation of the imaginary present in these periods, though with a twist, FAO argues for an approach to produce more with less to accommodate the pressing issue of depletion of natural resources while having to feed a still growing population:

> "The freshwater resources available per person have declined by more than 20 percent in the last two decades. (...) Agriculture has an important role to play on the path to sustainability, as irrigated agriculture accounts for more than 70 percent of global water withdrawals, and, globally, 41 percent of withdrawals are not compatible with sustaining ecosystem services." (2020)

Thus, the notion of producing more with less is underpinned by the understanding of water as a resource, as a utility within the agricultural sector, and simultaneously being a foundational pillar of ecosystems that sustains flora and fauna in all and every patch. The scarcity of resources will intensify unless the interaction between human and the more-than-human changes to accommodate a more modest balance, while adapting an approach to ensure a mitigating effect on climate change. Furthermore, FAO argues that the need to produce more with less is of the utmost importance due to a projected increase in global food demand by at least 60 % by 2050 compared to 2006 levels driven by growth in income and population (2016). Moreover, as determined throughout this analysis, the balance between developed and developing countries is skewed, almost always in favour of the developed regions, this is also true when looking at population growth:

> "In the coming decades, population increases will be concentrated in regions with the highest prevalence of undernourishment and high vulnerability to the impacts of climate change." (2016)

This need of producing more with less, can to some degree be seen as a stark contrast to the imaginary of the 'more is better' period, where FAO argued to include more land for agriculture, use more fertiliser, and technology. In the period of 2010-2021, FAO now argues

to be aware of land use in regards to sustainability, and that technology should be employed with care and considerations of possible negative consequences on and in the environment. These imaginaries of FAO are almost juxtaposed, and show the greatest degree of differences in any of the identified periods, thus showing a clear change in the STI and how to achieve this future vision, according to FAO.

To sum up the period of 2010-2021, 'sustainable development', and the STI present throughout is clearly a product of all the temporal trends that came before. The STI has grown, continued to include and acknowledge the increasingly intertwined problems that affect food (in)security; forming a nightmare-ish compilation of wicked interrelated problems, a monstrous leviathan. Spanning over; knowledge and technology transfer while focusing on the safety and sustainability of these transfers, gender-sensitivity in agriculture in combination with women in agriculture, the continued disparities in population growth, wealth, resources and food, and not to forget the disparities of climate change's consequences. The period of 'sustainable development' is thus the era of increased focus on patches, democratisation, establishment and utilisation of knowledge systems in line with *civic epistemologies*.

6.0 Discussion & Reflections

This section has been divided into two subsections; discussion and reflection on findings and discussion and reflections on the research design. The first subsection will present the three authors' reflections regarding the discoveries uncovered throughout the analysis of the FAO reports. Whereas the second subsection will present considerations and reflections regarding the methodological approach undertaken in this thesis, concluding with how the theoretical and methodological framework have impacted our findings.

6.1 Discussion of & Reflections on Findings

As observed throughout the analysis, the main STI held by FAO has remained the same since the foundation of the sub-agency and the UN, namely: to end world hunger. However, it has also become apparent through a historiographic examination of temporal trends that the way in which to achieve this STI has changed and evolved throughout time as the result of techno-scientific development, as well as social, economic, and political factors (see table 2).

Initially, the way in which to achieve the STI of ending world hunger has gone from the 'more is better' mentality where increasing agricultural output was seen as the main factor to achieve this goal. This increase in agricultural outputs was to be accomplished through modernization and technological advancements in agricultural practices. Whereas, in the following period, FAO moved on to a more complex understanding of possible solutions, including a focus on how these possible solutions would or could impact the environment as well as local 'patches', in combination with an inclusion of how 'patches' are affected differently by the same phenomena or interventions. When looking at the years influenced by globalisation and the information age, which further increased the intertwinedness of nation 'patches', the vision on how to eradicate hunger from FAO's perspective followed this development. Ultimately, it became more complex by encompassing an increasing amount of different factors. This is a clear example of how societal development and STI's are intertwined and affect each other. This development is reflected in the way FAO addresses these changes, moving further away from the 'more is better' mentality in the early periods, and in trying to improve food security here and now, to a more future oriented standpoint. FAO instead incorporated a focus on improving food security for future generations while simultaneously trying to improve the current food security: a combination of short- and long term interventions and programs. Additionally, the focus on future generations and their food security through the understanding of sustainable development of all sectors of society, including the agricultural sector, has become increasingly prominent. FAO has continued this line of development through the most recent time period in the reports: continuing to add factors, which are also present in other sectors of society, into their understanding of how to eradicate hunger, such as the gender gap, while increasing their focus on sustainable development. Thus, this development has led to an understanding of food (in)security, which has evolved in size and complexity, forming a nightmare-ish compilation of wicked interrelated problems; a monstrous leviathan.

As previously mentioned this thesis has been written within the realm of understanding the world through Haraway's notion of situated knowledges, meaning scientific knowledge is subjective and influenced by the eye that sees and observes the researched phenomena. This subjective perspective also applies to the findings obtained in this thesis, where the eye to be held accountable for what it sees, is our own. Thus the following section will be a reflection

on how our own positionality, both culturally and historically, may have affected these findings.

All three authors were born during the 1990's, and thus our world views are undoubtedly situated in and influenced by the events, social movements and the political landscape since then. This historical situatedness has affected the way in which we have interpreted data to create an understanding of the historical and societal specificities of all time periods we haven't experienced. This resulted in an understanding of these times partly based on historical sources, and the contemporary lens situated in our experiences, from a society and public understandings, realities, and ideologies which differ greatly from earlier periods'. When situated in modern times, it can be easy to judge certain ignorances in scientific knowledge, consequences of certain actions and prioritisations (which differs from how we personally would prioritise, as well as the contemporary way of prioritisation) during e.g. the 1950's. It can be difficult to put ourselves in the shoes of the public or FAO during times we haven't experienced, we do not understand their situated knowledge or perspective. To remain aware and reflexive regarding this possible gap in understanding, the historiographic approach to the analysis provided the framework to ensure reflexivity; by trying to situate the identified STIs and their proposed solutions in societal tendencies and historical events throughout time, prioritising the tendencies and events which have been mentioned in the FAO reports.

Another observation we made along the way was how FAO addressed developing countries through the separate periods, as this also reflects certain insight into the mindset of cultural and social perspectives in their respective times. The division of the worlds nations as "developed" in opposition to "under developed" ending in 1955, then "less developed" ending in 1980, onto "developing" ending in 2018, and finally in 2020 "least developed" until the UN decided to stop dividing the world in this way, has several problematic implications:

> "Over time the use of the distinction between "Developed regions" and "Developing regions", including in the flagship publications of the United Nations, has diminished. Since 2017, the Sustainable Development Goals (SDGs) report and the statistical annex to the Secretary General's annual report on SDGs progress uses only geographic regions without referring to the two groupings of developed and developing regions." (United Nations, n.d.-g)

For one, it presupposes a right way for nations to develop, based on a framework of the "developed nations" showing a technological or historical determinism, secondly it is a reductionistic simplification to categorise countries such as Brazil, Ethiopia and China as in the same situation. This simplification also risks portraying the countries in the 'not-developed' category, as all existing on the verge of starvation and collapse one and all. This can be problematized as FAO unintentionally (or intentionally) enforcing a homogenous and Western influenced narrative.

6.2 Discussion of & Reflections on Research Design

Throughout the entire process of writing this thesis, it has been of utmost importance to the three authors that they remained inquisitive, explorative and reflexive. Going into the process, we were all aware of the potential bias, due to our normative interest in climate change and its impacts, while holding our institutions accountable for not doing enough to mitigate the consequences of climate change in any and all settings. In an attempt to articulate and increase the awareness of these potential personal biases, section 1.3 Situated Perspectives was written as one of the initial sections of this thesis.

In accordance with the notions of being reflective, the iterative and exploratory approach to the development of the thesis was undertaken. We ventured into the field of food (in)security with no predefined idea of what we wanted to investigate within the field, utilising the literature review as a collective starting point. Aiming at allowing interesting topics, themes and questions to come to light, this resulted in several questions and a peak in interest arising around food (in)security through an institutionalised perspective. With an institutionalised focus we progressed further into the process of writing this thesis by formulating an initial draft of the problem formulation. But as the thesis process progressed, so did the problem formulation in line with Schön, who states: "(...) moves [through the research topic] produce unintended changes which give the situations new meanings. The situation talks back, the designer [researcher] has to listen, and as he appreciates what he hears, he reframes the situation once again" (Schön, 1991, pp. 131–132). Thus, through the process of identifying relevant theory for analysis, diving deeper into the researched topic, and the data collected, our understanding of the field evolved hand-in-hand with the problem formulation, methodological and theoretical choices.

Moreover, an exploratory approach to the field of food insecurity in an institutionalised setting was undertaken. The exploratory approach in the form of the methodological framework consisting of the slalom method and the complementary quali-quantitative approach, created an outset from which we could venture into the field with wide open eyes, remaining open to new knowledge, positions, and claims. Although, despite our efforts to create transparency, to stay aware, and reflective of our own position throughout the process, the analytical process can never attain complete neutrality, as stated by Haraway: "The 'eyes' made available in modern technological science shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building on translations and specific ways of seeing, that is, ways of life" (Haraway, 1988, p. 581). Thus, our situated positioning should be taken into consideration throughout the entirety of this thesis, to stay true to the notion of holding the eye that sees responsible for what it sees from Haraway's *situated knowledges*.

While an exploratory approach, as described above, provided the process of this thesis with a lot of elements of a positive character, the openness of exploration also comes with some limitations and challenges. One of these challenges, which has been prominent within this process, have been the lack of predetermined aspects throughout the process. With little to no preconceptions of the field of food (in)security from an institutionalist perspective, it has been a truly time consuming task to: identify where to look for information and data, choosing a theoretical framework, and how to contextualise and analyse this information and data. The lack of some predefined guidelines to help move along the project, meant that we needed to be constantly aware of any "rabbit holes", which would not contribute with any value in understanding the institutionalised perspective of food (in)security or meaning creation throughout the analysis.

Additionally, as almost predicted in the slalom method, the introduction of digital methods in traditional ethnographic inquiries can cause a series of problems, which we as researchers need to acknowledge, solve, or work around to continue any inquiry into the field. First, as techno-anthropologists we are not educated or necessarily trained in understanding the underlying technical language, in the form of code, that is the foundation for the functionality of the tools in the digital methods toolbox. Thus, challenging us in the fields of how to use the digital tools and how to remain reflexive throughout the analytical process when "some of the

underlying data sampling and algorithmic production are beyond our control" (Jensen, 2022, p. 3). Elgaard Jensen argues for four typical areas where problems can arise when implementing digital methods in ethnographic research, these are problems of priority, integration, digital data quality and problems of logistic. This thesis was faced with problems in three of the four areas: the first area of problems , priority, was present throughout the analytical process, we needed to remain explorative and iterative to stay true to the traditional ethnographic approach to fieldwork, thus we could not have a predetermined or fixed priority of the methods applied in the analysis. This materialised in countless experiments with different words in BERT, which led to little to no value in meaning creation, thus forcing a change of approach to these specific words and topics, namely close reading of the FAO reports. Moreover, experimenting with changes between qualitative and quantitative methods in respect to which method had the most to offer in the specific situation, following the notions presented in the complementary quali-quantitative approach. This is also the explanation to why only some periods in the analysis contain BERT-modelling, hence it has been used when it was deemed relevant. In the area of problems related to digital data quality, have come to light especially when we were trying to identify relevant data for the analysis, forcing us to have a pragmatic approach to data selection. The amount of data, if we had utilised the entirety of all the FAO reports would have been an enormous amount, and with a very strict time frame it was not deemed realistic to include the reports in their entity. Hence, each report was skimmed and the sections that provided a general overview of the current world state of food (in)security and the focus of FAO were selected to be representative for the rest of the given report. Moreover, as with any other data source, we have had a focus on the bias embedded in the collected data, which has been discussed in section 6.1 Discussion of & Reflection on Findings. In the fourth and last area in which problems can arise, we found ourselves struggling with logistics and time management. This is partly due to the previously mentioned factors such as; no prior knowledge of how to use BERT, thus we had to allocate time for learning how to use this digital tool, as well as the countless trials, errors, and attempts, with different words that provided none or little value to meaning creation.

Digital methods have, as mentioned, primarily been utilised to create a distant perspective of food (in)security. By distancing oneself from the specificities of the source material the picture painted and created by these methods can be of little nuance - naturally due to their aim being focused on creating an overview - yet this barrier of lacking detail have been

overcome by the introduction of the analytical approach of distant and close reading which respectively aims at: creating abstract approaches or views of literature works through visualisation, and "(...)reading to uncover layers of meaning that lead to deep comprehension" (Boyles, 2013, p. 1). Sense-making and validity was further sought through contextualising certain terms used in the FAO reports by utilising BERT, and through the historiographic approach.

The exploratory approach in combination with the application of Haraway's notion of 'no such thing as objective knowledge' have set us free. Meaning, by removing the 'burden' of being concerned with identifying and finding the objective truth about food (in)security from an institutionalised perspective, the exploratory and iterative nature of ethnographic research was allowed to thrive. This perspective decreased the nervousness and the frightening aspects of experimenting with digital methods (some of these challenges mentioned above). Due to the traceability of one's steps, like footsteps in the snow, allowed for the process to be riddled with iterative learning experiences and methodological reflexivity.

7.0 Conclusion

The aim of this thesis was to explore sociotechnical imaginaries surrounding food security in an institutionalised setting as well as how these imaginaries materialise, are being performed in and extend across the globe, thus the problem statement was formulated as followed:

> *What sociotechnical imaginaries are, and have been, enacted in the institutional setting of the Food & Agriculture Organisation regarding the global problem of food (in)security in the Anthroposcenic era? And how are these sociotechnical imaginaries related to civic epistemologies and patchy locality?*

Through the historiographically inspired analysis of temporal trends, it became apparent that the sociotechnical imaginary held by the Food & Agriculture Organisation, namely to eradicate world hunger, is indeed a durable one, and has remained the same through the years of 1947 to 2021. The changing aspects of the STI have been in how FAO is trying to enact and accomplish the no hunger imaginary, moving from a 'more is better' perspective where increases in production and the materials used for agriculture were seen as the solution to eliminating hunger, to today's contemporary notion of 'produce more with less'. How the STI, and how to achieve it, went through this transformation has been reflected throughout the various periods identified, e.g. technological advancements, the Green Revolution, globalisations, wars, crisis, the gene revolution, and climate change. Through applying the notion of *civic epistemologies* it was found that FAO's decisions and their policy making process has become more democratic and inclusive of different forms of knowledge, e.g. from the public, small scale farmers, scientists, etc. That is the reason as to why the concept has been applied in the later periods as opposed to earlier ones, because there was no, to very little, trace of these tendencies. This underlines what was stated above, that FAO's ways of navigating and addressing the issue of world hunger carry traces of a more complex, multifaceted, holistic, and 'patchy' approach compared to its origin.

By looking through the lens of the *patchy anthropocene* it was found that 'patches' similarly shape the ways in how FAO attempt to extend and achieve their STI. In an increasingly globalised world, the notion of looking at feral proliferations and modular simplifications helped gain a better and more holistic understanding of the climate crisis and the food security

issue, site-specifically as well as on a planetary scale. It became apparent that certain actions and decisions of one nation, had unintended consequences for nations in a separate part of the world, thus underlining the interconnectedness of factors regarding food (in)security. This could also explain the reason as to why some nations show a form of resistance to the STI held by FAO, as the values and concerns are site and culturally specific to individual 'patches'. Thus, underlining and adding to the complexity of the solutions to food insecurity.

The identified shifts within the STI, and the changes in ways of addressing food (in)security, is seen as being materialised in the shape of development strategies, policies, programmes and changing priorities, all of which have changed partially or completely over the years. Even though the main STI has remained the same, the path towards a world without hunger has been long and winding, stretching into the horizon and out of sight.

8.0 References

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