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Converging Citizens? Understanding Public Response to Emerging Technology in the UK and Ghana

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Abstract

Earlier studies aimed at understanding public responses to emerging technologies have shrouded the social, economic, and political considerations that render public concerns culturally meaningful. Therefore, public concerns are often reduced to statistical distribution. This, I argue, calls for studies that employ novel deliberative methodologies to conceptualize public discourses on novel science and technology. Using GMOs as a typology, I aimed at a comparative understanding of public engagement as a method of governance across different national contexts - between the North (UK) and South (Ghana).

To do this, I set three distinct but interconnected objectives: first, I aimed to understand what narratives are deployed in public discourses on emerging technologies in the UK and Ghana; second, how do the opinions of the publics in these national contexts are formed and configured into a singular group vocabulary in an interactive dialogue; and last, what implications can be drawn for policymaking.

Using data from focus group discussions held with the publics in the UK and Ghana on GMOs, I developed five cultural narratives that were salient in structuring and understanding the responses of the people in each group (the UK group and Ghana group). In each group, the narratives initially emerged as individual contributions but later appealed to others and were configured in the discussion as a collective resource to structure and reflect the overall group effects and vocabulary.

Generally, the responses in both groups were more tragic, with a collective expression of lack of confidence in scientific innovation and modernity. This was informed by questions of technoscientific failures, trust, purposes and meanings of technology, ethics and morality, equity and ownership, and to the perceived alienation from science endeavours. The implications for policymaking are discussed, with key recommendations made.

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<div align="center">**Chapter One**</div>

<div align="center">**Conceptual Design**</div>

1.1   Introduction to the study

The role of science and technology in addressing some of the global socioeconomic development challenges such as hunger and poverty cannot be overemphasized. Current statistics shows that the world's population is predicted to increase from 7 billion to 9 billion by 2050 (Macnaghten and Carro-Ripalda, 2015). As an attempt to meet human food consumption in the not too distant future and also reduce global hunger, many scholars and policymakers have highlighted the need to advance and scale up the application of agricultural intensification driven technologies in the agricultural sector. Already, the successes and strengths of the current agricultural system can, in large part, be attributed to the advances of science and technology in the sector. Despite the benefits the current agricultural system have derived through the application of science and technology in the areas of crop and animal improvement, mechanization and digitalization, and postharvest practices, the adoption of certain novel agricultural technologies have been stilted with a lot oppositions and resistance from the public and NGOs. Agricultural genetically modified organisms (GMOs) is perhaps the contemporary scientific advancement in the agricultural sector that has been welcomed with much ambivalence (Hanrahan, 2010; Legge and Durant, 2010; Bonny, 2003).

Since the inception of agricultural GMOs, it has spread rapidly and gained acceptance in some parts of the world (see ISAAA, 2018). Historically speaking, the first GM crops were commercially planted in 1995. By the year 2000, a total of 44.2 million hectares of GM crops were grown in thirteen (13) countries (James, 2001). In 2018, countries growing GM crops increased to twenty-six (26) – twenty-one (21) developing countries planted 103.1 million hectares representing 54%. And five (5) industrial countries planted 88.6 million hectares representing 46%. It is predicted that the cultivation of GM crops will increase in the future following the increasing number of countries in the southern hemisphere adopting biotech crops (ISAAA, 2018).

Despite the significant increase in the use of agricultural GMOs and its predicted potential to contribute to reducing global hunger and bring both environmental and economic benefits, the acceptance and regulation of the technology has been highly controversial and contested in different parts of the world, especially in Europe and Britain. For example, results from the 2002 Eurobarometer (including the UK) shows that majority of Europeans perceived both GM crops and foods in entirely negatively light. The survey also highlighted that, even when comparing GM

technology with three other controversial novel technologies, including: nanotechnology, pharmacogenetics and gene therapy, majority of the respondents in the sample rated GMOs as the riskiest of the four (Gaskell et al, 2006). Such polemic poses serious challenges for the acceptance and governance of the technology (see Kyle & Dodds, 2008).

In the context of Africa, the primary reasons for introducing GMOs into Africa, including Ghana, are improved yield, food security and economic benefit to farmers (Vecchione and Verma, 2005). A few African countries, namely: Egypt, Burkina Faso, and South Africa have already approved GM technology and have started to commercialize its use (Wambugu and Kamanga, 2014). Many other African countries such as Ghana, Kenya and Nigeria have passed their regulatory acts, but have still confined its use for now to field trials. The introduction of GMOs into these countries has raised a lot of debates and protests largely from NGOs, as witnessed in Europe and Britain. Ghana is in the process of deciding how and whether to commercialize the use of agricultural GMOs. Currently, the Council for Scientific and Industrial Research (CSIR) is conducting confined field trials of two GM crops in Ghana: Bt cowpea and GM Rice (also known as 'newest' rice).

Several scholars have shown that the polemic against GMOs has probably being the most explored academic subject in terms of public conceptions of emerging technoscience (Jasanoff, 2005; Pellegrini, 2005). However, notwithstanding these moves, no research aimed at comparative understanding of public engagement as a method of governance across different national contexts - between the North and South has been conducted to compare and theorise public responses to emerging technologies (like GMOs) in this different international settings. Therefore, I argue that, there is a knowledge gap in terms of understanding the 'ideal and promise' of public engagement respond to different national, political and 'epistemic contexts', and the extent to which such cultural responses differ across the North and South. In this study, I aim to contribute to understanding cross-cultural public response to novel science and technologies.

1.2   Objective of the research

In this research I have three distinct but interconnected objectives: first, I aim to understand what narratives are deployed in public discourses on emerging technologies (using GMOs as a typology) in the UK and Ghana; second, how do the opinions of the publics in these national contexts are formed and configured into a singular group vocabulary in an interactive dialogue; and last, what implications can be drawn for policymaking.

1.3   Research questions

Based on the objectives of the research as outlined above, the following research questions are set to direct and guide the lines of the inquiry.

1. What substantively are people concerned about when engaged in discussions on an emerging technology, how are these concerns formed, and what level of generality can be attributed to these matters of concern?

2. What narratives do people deploy in their response to an emerging technology in an interactive group discussion, how do these narratives emerge, and to what extent are these narratives shared or distributed across different culture and political contexts.

3. What epistemological significance do these narratives command in relation to the enlightenment master narrative of science, and what implications do this hold for policymaking.

1.4   Scientific and societal relevance of the study

This research is crucial because until now, public response to emerging technologies across different national contexts, particularly between the North and South is not understood. This study will provide such enlightenment, contribute to social science scholarship on upstream public engagement of science, and serve as a policy toolkit. Again, this study will also bring into light the variety of counter-narratives that publics across different national contexts deployed in rendering emerging technoscientific endeavours culturally meaningful. Such knowledge is crucial for facilitating a more participatory governance approaches, and for aligning technological innovation trajectory with societal values.

1.5   Organization of the thesis

This thesis has been organized into nine (9) chapters. Chapter one (1) introduces the focus of the research and the conceptual design. Chapter two (2) highlights the evolution of GMO controversy in the UK and Ghana. Chapter three (3) elaborates the theoretical framework underpinning this research. Chapter four (4) gives insight into the technical design. Chapter five (5) examines the political imaginary of public engagement in the UK and Ghana and set out the research. The next two chapters (6 and 7) present the analysis of public responses to emerging technology in the UK and Ghana, respectively. The following chapter (chapter 8) offers a comparative analysis of the two groups – the publics in the UK and Ghana. The last chapter (chapter 9), discusses the key conclusions and implications that has been drawn for policymaking.

<div align="center">**Chapter Two**

Evolution of GMO controversy in the UK and Ghana</div>

2.1   Introduction

Since GMOs have been employed in this study as a typology for understanding the responses of the public to emerging technologies across different national contexts (the UK and Ghana), I want to give an overview of how the GMO controversy has evolved in these two national contexts. I will begin with the controversy in the UK and afterwards that of Ghana. I will then conclude with the key trigger of the controversy in these national contexts.

2.2   GMO controversy in the UK

In Europe, the debate over the application of techniques of agricultural biotechnology – particularly GMOs has been controversial, with government, scientists, regulators, civil societies, and the public as key stakeholders in the debate. At the European level, increasing Europeanization and globalization facilitated the authorization and importation of GM products into the European Union. However, it also poses challenges in dealing effectively with GM products (Levidow et al., 1999; Grabner et al., 2001). The 'common market' led the European Union to centralize their regulations of agricultural biotechnology. The harmonization came with a lot of problems because there was a significant difference in the regulation and history of GM debate among individual member state (Robinson, 1997; Grabner et al., 2001). At the same time, the harmonization of the 'common market' facilitated the importation of GM products across Europe, without any formal consideration of the arising issues at the individual member states (Simmons and Weldon, 2000). Besides, the new global trade rules (World Trade Agreement) made it impossible for the European Union and member states to stop importation of GM products (Grabner et al, 2001).

Historically, the first authorization for commercialization of GM products in Europe happen in April 1996, when the European Commission approved and authorised the importation of Monsanto's GM Round-up Ready soya (Marris et al, 2001). By the end of November 1996, GM soya from the United States was imported into the European Union (Marris, et al, 2001). At this time, there was little public awareness about GM crops and foods, following the traditional approaches that was adopted by various governments to govern and regulate the use of technology. Civil society organization, Greenpeace launched European-wide anti-GMO campaign through a range of arguments and mobilized public support in the process (Marris et al, 2001). Such move by Greenpeace, which was later joined by other consumer and civil societies (or NGOs), influenced public perceptions and

attitudes to GM crops and foods. By the end of 1990s, majority of European public have turned against techniques of genetic modification and GM foods, and pressure from civil societies forced supermarkets to stop selling GM products (Simmon and Weldon, 2000).

In the case of the UK, aside the anti-GM campaigns launched by civil societies and consumer groups, other factors also contributed to the polemic against the technology, which later led to its rejection. For example, in the late 1990s, the UK government embarked on a nationwide programme aimed at assessing the impacts of GM herbicide crops on farmland biodiversity (Simmon and Weldon, 2000). Such move by the government did not go well with anti-GMO campaigners. They registered their displeasure by destroying several field trials sites. This led to the arrest of these anti-GMO campaigners. This incident heightened public outrage against the technology and deepen the controversy in the media (Simmon and Weldon, 2000). Again, the cloning of the 'Dolly' sheep by a group of scientists in Scotland, in many part, also contributed to the controversies surrounding the technology, as the public and media became alarmed about the ethics of agricultural biotechnology (Einsiedel et al., 2002).

Moreover, the UK government's corrosive handling of the BSE (mad cow disease) crisis had a significant impact on public trust in new science, including GM crops and foods. When it was first discovered that there is a widespread of BSE among cows in the UK, the government turned deaf ears on the issue and rather, claimed that British beef is safe for consumption (Simmon and Weldon, 2000). Information from the later proved otherwise. Following the BSE crisis, the public began to caution against expert knowledge, expressed concern about risks and uncertainties that novel technologies are likely pose and lost trust in their government (Grove-White et al., 1997; Durant et al., 1998; Jasanaoff, 1997).

2.3   GMO controversy in Ghana

In the context of Ghana, Ghana's foray into the world of agricultural biotechnology (referring to GMOs) can be traced to 1998, when the government set up a National Biosafety Committee (NBC) to give advice on biosafety issues and spearhead the negotiation on the Convention on Biological Diversity (CBD). Following the adoption of the CBD in 2004, Ghana committed to the sustainable use of biological resources, including their genetic material (Vecchione and Verma, 2005). Between 2004 and 2008, a Biosafety Bill was drafted as well as the National Biosafety framework, setting up the basis for the underlying legal framework for biotechnology and biosafety policy in Ghana including laws, guidelines and regulations to govern biotechnology practices, mechanisms to handle requests for permits, exercise monitoring and inspections, and a system to promote information and public awareness (Vecchione and Verma, 2005). In 2011, the National Biosafety Act was approved

by the Parliament of Ghana. The Act provides the guiding framework for Ghana to develop and regulate biotechnology, particularly GMOs, but under certain conditions to ensure safe and protected transfer, handling and use of GMOs that may have an adverse effect on health and the environment. The Act was based on the Cartegena Protocol on Biosafety after the localization of the latter. This protocol is an international one purposely designed to guide safe use of genetic modification.

The guiding framework was established to ensure transparent and predictable processes of reviewing and making decisions on GMOs and related activities (Biosafety, 2011; p.3). As mandated by the Biosafety Act (2011), in February 2015, the National Biosafety Authority (NBA) was established as the regulatory institution authorized to implement the guiding framework. The NBA aims at promoting public awareness and participation concerning GMO development and use in the country (Biosafety Act, 2011; p.3). The Act also mandates NBA to establish a biosafety laboratory to enable the Authority to successfully carry out its activities. The inauguration of the NBA led to the commissioning of research on GM development in Ghana, which was aimed at modifying strategic local crops, to make them more resistant to pests and diseases, more adaptable to changing climatic conditions and more productive in terms of yield.

Currently, the Council for Scientific and Industrial Research (CSIR) in partnership with foreign organizations are seeking to introduce GM crops into the country. As indicated ealier, two GM crops: Bt cowpea and GM rice (also known as 'newest' rice) are undergoing confined field trials. The CSIR, and some farmer organizations, including: Ghana National Association of Farmers and Fishermen (GNAFF) and CropLife Ghana (CLG) have advocated that agricultural biotechnology holds the potential to modify strategic local crops, to make them more resistant to pests and diseases, more adaptable to changing climatic conditions and more productive in terms of yield. Despite these optimistic claims, the proposed application of the technology in Ghana has sparked significant controversies and debates. While the CSIR and some farmer organizations are optimistic about the technology, the Ministry of Food and Agriculture (MoFA) and some civil society and farmer organizations, including: Food Sovereignty Ghana (FSG), Earth Replenishers Foundation (ERF), Vegetarian Association of Ghana (VAG), Convention People's Party (CPP), Peasant Farmers Association of Ghana (PFAG) and Darsfield Village Farms (DVF) have demonstrated significant reservations towards the technology. Much of the scepticism and controversies hang around the efficacy of implementing regulations and to the perceived socioeconomic, cultural, and political impacts of the technology in Ghana.

Civil society and farmer organizations who are contesting against the commercialization of the technology, have mobilized four key arguments to support and crystallize their position. First, these groups are highlighting the failure of the regulatory institutions to create public awareness as the

regulatory framework mandates National Biosafety Authority (NBA) to do, considering plans to commercialize Bt cowpea. Second, the absence of public participation in the ongoing development of the GM crops has led these groups to also raise concern regarding the ability of NBA to adhere and execute its responsibilities defined by the regulatory framework. Third, the NBA's decision to publicly declare the Authority's readiness to receive GM proposals in the absence of a biosafety laboratory, has not gone well with these groups. They perceived that such move by NBA in the absence of a biosafety laboratory is a clear evidence that the Authority will not execute its formal duties and responsibilities. The key question underpinning this argument is that: in the absence of a biosafety laboratory, how would NBA be able to carry out the various safety assessments independently and effectively on GM proposals the Authority will receive?

Last, they are also pointing out to the inability and failure of the regulatory institutions to stringently enforce the regulatory standards concerning importation of GM foods, as they shown that some GM foods have found their way into the market without going through the formal rigorous approval processes spelt out by the regulatory framework. Some civil society organizations are now preparing a litigation against government, aimed at halting the development of GMOs in the country.

2.4   Conclusion

To summarise, in the context of Ghana, the polemic against the technology has ensued between formal governmental institutions, civil societies and farmer organizations, with the voice of the wider public missing from the debates (like the UK context). However, in the UK, the debates on the technology was mainly between government and industry (on one side) and NGOs and the media (on the other side). It can be observed that in the UK, expert systems were unified in their discourses and opinion, and thus, arrived at one side of the debate. This is contrary to the case in Ghana, where formal governmental institutions involved in decision making and regulation of the technology have arrived at a strikingly different position. In addition, in both national contexts, the controversy surfaced, largely because of the deficit model that expert systems adopted to regulate the technology.

Importantly, as at the time the GMO controversy arose, in both contexts, there was no formal mechanisms to make consideration of public concerns. This provides a fundamental premise on which this comparative analysis is being carried out. In chapter 5, I will draw on this, and other salient justifications to set up the analysis.

Chapter Three

Theoretical framework

Comparative analysis of public responses to emerging technoscience is one of the studies that is yet to gain currency in Science and Technology Studies (STS) and social science studies on novel science. For GMOs, these studies are rare. This makes this comparative analysis very useful in terms of its scientific and policy relevance. In this study, I aim to develop a comparative analysis – identifying the commonalities and differences in response GMOs across national contexts (specifically between the UK and Ghana), how these narratives may themselves represent geographically distinct ways of engaging with science and technology, and how they relate to the enlightenment master narrative of science and modernity. Since this study appears to be new area of scientific inquiry, the question is: what theoretical resources are salient in structuring and understanding the responses of the public to novel technologies?

To answer this question, I have employed the narrative approach – a theoretical resource that helps to explore and understand how the opinion of the public are expressed, formed, and eventually crystallized in an interactive dialogue such as focus group discussion. Earlier approaches, including the social interactional approach of exploring and understanding the responses of the public have shroud the wider social, economic, and political processes that develops public responses to novel science and technology (Macnaghten et al, 2019). Therefore, rather than seeking to uncover a 'priori attitude', I aim to explore and understand the social and political contexts through which public responses to GMOs emerge in a conversation, and how such responses are being configured in a discussion in light of the people's cultural values and the institutional context that render public responses meaningful.

The narrative approach has five (5) design features. However, because this inquiry employs a secondary data, I have focused on using three (3) of the design features, namely: 'context', 'framing', and 'analysis and interpretation'. The figure (1) below illustrates the five (5) design features.
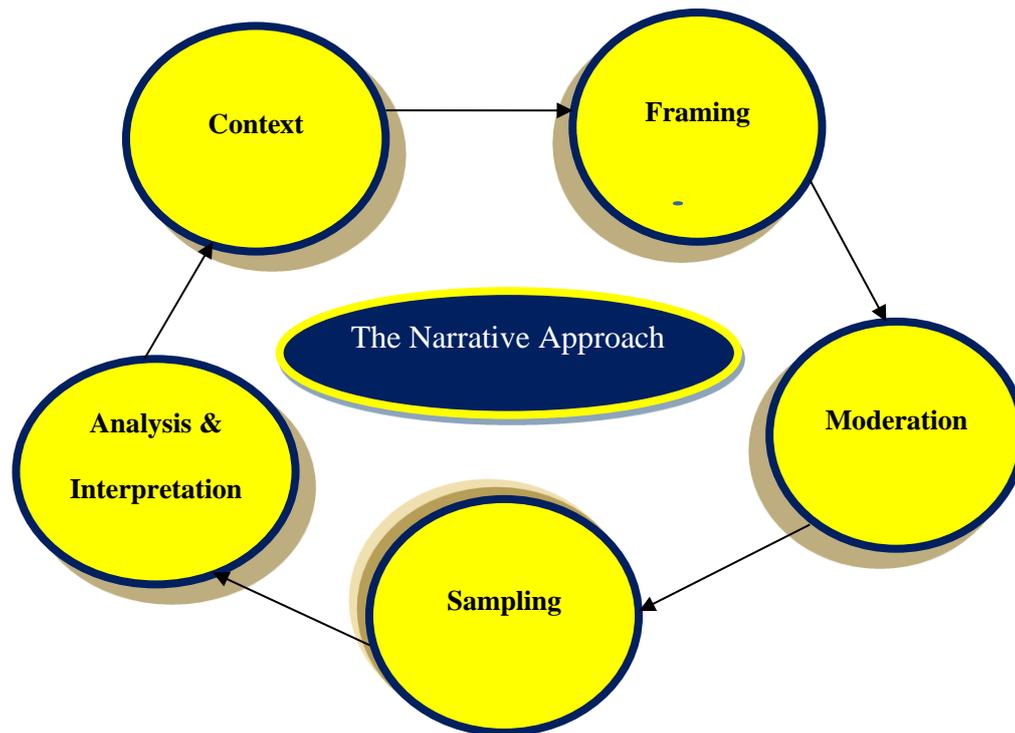
Source: Modelled from Macnaghten, 2020

'Context' is the first design feature of the narrative approach. This design feature assumes that, by definition, the public are unfamiliar with emerging technologies and the social and ethical issues they pose (Macnaghten, 2020). This makes it needful for a public understanding of science (PUS) data analyst to explore the context out of which public responses are likely to stem from. How people engage with and the responses they form about emerging technologies is shaped by a variety of contextual factors – largely social and political factors. I operationalized this dimension of the approach in the analysis by identifying the relevant everyday experiential practices (which in both groups was people's experiences with food) that gave clues to the salient factors likely to structure and shape the responses of the people to GMOs.

The second design feature is 'framing'. Framing can be defined as "the selection of some aspects of a perceived reality to make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described" (Entman, 1993: 52 cited in Macnaghten, 2020: 10). This design feature assumes that an emerging technology can never be represented as a neutral artefact, rather, it is always framed in specific ways and for a specific predetermined purpose (Macnaghten, 2020). Framing an emerging technology involves considering the potential uses of the technology and its wider societal impacts. To operationalize this design feature in the analysis, I explored how

people responded to the mainstream narratives that expert systems (particularly government and industry) use to represent GMOs.

The 'analysis and interpretation' is the fifth design feature and is the last feature I employed in the study. This design feature focuses on identifying and analysing how people talk in a focus group discussion setting and the substance of the conversation [or what people say] (Macnaghten, 2020). The feature requires a data analyst to find meanings to both the form and substance of the conversation. Here, I read through the focus group transcripts several times and become acquainted with the raw data. Afterwards, I organized key rhetorical arguments into themes using codes and then identified the interplay between thematic concerns and their wider discourses and narratives. In addition, I interpreted these meanings within a framework of social theories and policies.

<div align="center">**Chapter Four**</div>

<div align="center">**Methods**</div>

This chapter presents the technical design of the study. The chapter elaborates the research design, sample and data collection strategy, and data analysis method.

4.1   Research design

Considering the aim of this research, the study employed a parallel case study design. De Vaus (2001) shows that, a parallel case study allows a researcher to explore two research cases simultaneously and study the commonalities and dissimilarities that exist between the cases and the scientific implications such comparisons holds for theory building. It is also shown that parallel case study design is particularly useful for qualitative research that aims at developing a more complex and fuller explanation of two or more cases (De Vaus, 2001). The strength and scientific relevance of parallel case study design as shown above, made it particularly useful for this research. Thus, leading to its selection and use in this study.

4.2   Sample and data collection strategy

The study made use of secondary data that was collected from focus group discussions held with publics in the UK and Ghana. To set a common and a fair scientific basis for the comparison, the same methodology (topic guide) was used to guide the focus group discussions in both countries. In the case of the UK, the focus group discussions were organized in 1996/1997 and in total, eight (8) in-depth focus group discussions were held for diverse publics, including college students. In the case of Ghana, the focus group discussions were organized in 2019 and in total, four (4) in-depth focus group discussions were held for university students. Even though different research samples were used for the focus group discussions in the UK and Ghana, the methodology (and other salient reasons as discussed in chapter 5) sets a common basis for this comparative analysis.

The study purposefully employed data from focus group discussion, because focus group discussion method helps to fully explore how the opinions and views of people are expressed, formed and how they are subsequently solidified into attitudes (Macnaghten, 2017). Also, it is shown that focus group discussion method is useful in conducting research that aim to explore public perceptions and concerns on emerging technologies (Wilsdon and Willis, 2004). In all, the study employed secondary data from twelve (12) focus group discussions organized in the UK and Ghana.

4.3   Data analysis

The data of each group (Ghana and the UK) was analysed independently and based on the three (3) selected design features ('context', 'framing' and 'analysis and interpretation') of the narrative approach. In so doing, the substance of the conversation of each group was organized into logical arguments using codes. These arguments were then articulated systematically, taking into consideration the interplay between arguments and discourses. A comparison aiming at establishing the commonalities and differences between the two groups was then drawn and its implications within the framework of policy and theory was discussed.

In chapter (2), I set the foundational premise on which this comparative study is being carried out. In the chapter that follows (chapter 5), I aim to explain into details the rationale behind the comparison and to bridge the existing time and political gap. Thus, setting a common ground for the comparative analysis.

<div align="center">

Chapter Five

Bridging the Gap: Setting up a Common Ground for the Analysis

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5.1   Introduction

This chapter (chapter 5) is an introductory chapter to the analysis in the two chapters that follow. Considering the cultural and political disparity between the UK and Ghana in recent times and the strikingly different time frame at which the focus group discussions were organized in each country, it is imperative that I bridge this gap by setting out a reasonable common ground for the comparative analysis. This is the objective that has been advanced in this chapter. As a way of bridging the gap, I have made two distinct but interconnected moves: first, I will describe the political imaginary of public engagement in the UK and Ghana; and this would be followed by advancing arguments (partly based on the first move) aimed at bridging the political and the time disparity.

5.2   Political imaginary of public engagement in the UK and Ghana

The desire to align innovation trajectory with societal values has evoked the need to engage the public in technoscientific endeavours. Early moves, the participatory science governance approaches which were driven by deliberative methodologies, was aimed at engaging lay views in science discourses and public debates. However, this desire to 'include, reflect on, anticipate and institutionalize' (see Stilgoe et al, 2013) lay views as underpinning participatory approaches, is in some respect embedded in European (particularly British) science culture (Macnaghten and Guivant, 2010). In the UK, the growing failure of expert systems to anticipate adverse public reaction to the risks issues, entwined with the pitfalls of science and innovations was postulated as a key institutional failure in the past decades.

Following the considerable fatal handling of the BSE crisis (see Simmon and Weldon, 2000) and the precariousness of the Creutzfeldt-Jakob disease (CJD), many scholars and institutions put a number of salient policy reports across, all requiring, among other things, a dynamic public engagement in debates and in appraising and conceptualization of the distinctive social and ethical issues associated with science and technology (Macnaghten and Guivant, 2010). Following the oppositions from NGOs in addition to late public resistance to GMOs and nanotechnology, techniques of agricultural biotechnology and nanotechnology was presented as key site for trialling the novel form of upstream public engagement (see Grove-White et al, 1997; PABE, 2001; Macnaghten and Guivant, 2010). Now, in the UK, there is formal institutional commitment to include the public in debates and deliberations on emerging technologies.

In the context of Ghana, the situation is more different. Perhaps, GMOs is the first technoscientific endeavour that have given rise to technological risk controversy. 'Less controversial' science and innovations are governed by the linear and deficit approaches, with no involvement of the public. However, this does not mean that science, scientists, and expert systems are held in high regard in public opinion. Probably, the public have over the years been 'kept in the dark' following the lack of recognition and conceptualization of the science-society relations. Generally, in Ghana, the regulatory system is characterized by cumulative failures in terms of enforcement of regulatory laws and standards. This, coupled with political disappointments has created a climate, characterized by apathy, distrust in expert systems, and a culture of silence. Against such a context, it is less surprising that scientists and technologists are generally detached from the consequences of their activities and hold no formal responsibility whatsoever.

Unlike in the UK, where the risk controversy over GMOs was widely and formally posited as evidence of the need for a more upstream engagement science governance approaches (Macnaghten and Guivant, 2010), in Ghana, the debate has a different pivot. Currently, the GMO controversy in Ghana is gradually developing into an impasse with some formal institutions of government (including the Ministry of Food and Agriculture), NGOs and influential farmer organizations arriving at a strikingly different position.

Even on the few occasions where the regulatory institutions (National Biosafety Authority and Food and Drug Authority) held a stakeholder meeting with the two coalitions - actors who are moving for the commercialization of the technology (including Ministry of Environment, Science, Technology and Innovation, Council for Scientific and Industrial Research, and Ghana National Association of Farmers and Fishermen) and actors who are against the technology, such exercise did little to reflect a participatory approach – as the meeting was based on the 'information deficit' model and thus, without any room for 'reflectivity', 'anticipation' and 'responsiveness'.

Furthermore, even though Ghana's regulatory framework for regulating GMOs (Biosafety Act 2011) requires public participation in the decision-making processes, such important tenet has been neglected, perhaps, because of lack of institutional commitment and efficacy. To summarise, in Ghana, there is little perceived institutional need to engage society in debates and deliberations on governance of technoscience nor incorporate wider considerations back into innovation trajectory. Generally, the silence over public participation in Ghana, despite the confrontations and litigations (advanced by Food Sovereignty Ghana) has reinforced and crystallized the traditional and deficit model.

5.3   Bridging the time and political disparity

Comparative analysis has been shown to be good for studies that aim to develop an in-depth understanding of a case (De Vaus, 2001). Sheila Jasanoff (2005) also advanced that comparative analysis is salient when deployed to explore the interaction between science and policy. In this study, I aim to use comparative analysis to understand and theorize how the public in the UK and Ghana interact with novel technologies – with GMOs as a prototype. Besides, I also aim to compare the cultural narratives that are salient in structuring and understanding the responses of the two group (the publics in the UK and Ghana) to GMOs.

Jasanoff (2005) pointed out that a comparative analysis works well "when entities to be compared are different enough to present interesting contrasts, yet similar enough for the variations to be disciplined" (Jasanoff, 2005: 29). The UK and Ghana are geographically apart, with strikingly different socio-economic, cultural, and geopolitical conditions – more specifically, the UK in the North and Ghana in the South. However, with respect to the evolution of the GM controversy, the political imaginary of public engagement in the UK and Ghana as at the time GMO controversy emerge, the methodologies employed in both contexts, and the colonial relations set a common ground for this comparative analysis.

To be more precise, in 1996/1997, the UK was deciding whether to develop and receive GM crops and foods, following the debates and arguments that was advanced against the technology by NGOs (in the UK). As at that time, the voice of the UK public was missing from the debates. To involve the public in the debates and deliberations on the technology and understand public concerns, led to the UK focus group discussions (used in this study). The UK focus group discussions were held for a variety of publics (groups).

Similarly, the focus group discussions for the Ghana group was also held at an equivalent time, in 2019 - where Ghana was also asking the same question: deciding whether to develop and receive GM crops and foods, following the controversies and litigations advanced against the use of the technology by NGOs (in Ghana). Unlike the UK focus group, the Ghana focus group was held for university students – with academic backgrounds in humanities, business, social sciences, and physical and agricultural sciences. Generally, even though the focus group discussions for the two groups (the UK group and the Ghana group) was held at an extreme different time frame and with different set of publics, the group discussion was organized at an equivalent time in the evolution of GMOs in each country.

What is more, around the 1996/1997, science and technology governance in the UK was dominated by the deficit model, with little or no public engagement. Like the UK, the linear and deficit

approaches is still the dominant science governance framework underlying most technological developments in Ghana, including the proposed GM development. Thus, as at the time the group discussions were held in each country, public engagement programmes were rare and not integrated into their political culture and there had not been a significant public debate and deliberations on the technology. Perhaps, it can be argued that the group discussions in each country was a way of experiment with novel forms of upstream science and technology governance methodologies. Furthermore, the same methodology, topic guide was used to moderate and guide the discussions in each country. In the same way, the same analytical framework (the narrative approach) was used to analyse the discussions for each group. This was aimed at setting a common ground for the comparative analysis of the two groups.

In the next two chapters (chapter 6 and 7), I have used the narrative framework to analyse the focus group discussions for the UK and Ghana groups, respectively. It must be noted that, I do not aim to make an all-inclusive analysis. Rather, I have focussed my effort on the recurrent thoughts that were central in all the discussions for each group. In so doing, all the salient threads that ran through the discussions are methodically and meaningfully reproduced in the analysis. To maintain consistency and enhance the coherence of the analysis, the analysis of each group has been developed to follow this pattern: I set out the analysis by first: understanding the context in which GMOs are embedded and the key factors that are likely to structure the response of the people to the technology. This was followed by an examination of the people's response to how expert systems (particularly government and industry) frame GMOs. Last, I identified and discussed the key cultural narratives that are salient to the people, when engaged in conversation on GMOs.

<div align="center">**Chapter Six**</div>

<div align="center">**Public Response to Emerging Technology in the UK**</div>

6.1   Introduction

This chapter (chapter 6) offers the analysis of the focus group discussions held for the publics in the UK. In the analysis that follows, I do not aim to make an exhaustive analysis. Instead, I have focussed my effort on the recurrent thoughts that were central in all the discussions. In so doing, all the salient threads that ran through the discussions are methodically and meaningfully reproduced in this analysis. To enhance the coherence of the analysis, I have made a number of distinct moves in this chapter. I begin the chapter by first: exploring and critically examine the context in which GMOs are embedded and the key factors that are likely to shape the response of the people to the technology. Afterwards, I will examine the people's response to how expert systems (particularly government and industry) in the UK frame the technology. Furthermore, I will identify and discuss the key cultural narratives that are salient to the publics in the UK, when engaged in deliberations on the technology.

6.2   Context and factors likely to shape public response to GMOs in the UK

Context, as the first design feature of the narrative approach assumes that, the public is unfamiliar with emerging technologies in terms of their conventional definition and the social and ethical issues they pose. Such assumption makes it imperative for public understanding of science (PUS) analysts to explore and understand the context in which an emerging technology is grounded and out of which public responses are likely to stem from. Macnaghten (2020) shows that, one way to achieve this, is for a PUS data analyst to explore and understand the relevant everyday experiential practices related to the technology.

In the UK, the focus group discussions began with a deliberation on recent [or new] technologies, products, or services that have affected the lives of the participants. Much of the deliberations in this direction was focussed on what had changed in the world of food in recent times, and what the people have gained or lost. Broadly speaking, the deliberations were enlightening as participants expressed their ambivalence towards the recent use of innovative services and advanced technologies in food. The people identified that, genetically modified foods, fast (convenience) foods, and more organic foods are in the food system now.

Also, microwaves, chemical preservatives, plastic packaging, and innovative food services such as: virtual shopping and home food delivery services were also identified as innovative services and advanced technologies in food.

For most people, these innovative services and technologies had led to convenience, more choice, greater international varieties, made food more attractive, improve access to food, increase productivity, and has also saved time and effort. However, there were a lot of concerns about the side effects of some of these innovative services and technologies. People felt that some of advanced (innovative) technologies in food is making food unnatural, unsafe, less nutritious, and also has inevitably increase food fraud and encourage laziness. Amazingly, organic foods were also considered unsafe and were tagged as a source of many food frauds. Some participants speaking in this regard said:

> *Female:* *Like we just said right. You can be eating an organic apple say and there could be some really toxic creature inside it waiting for you to eat its head off or something and dies well not quite as bad as that but you could eat a worm.*
>
> *Female:* *Just because someone says it's organic doesn't mean it actually is, does it?*
>
> *(UK Group 1, Blackpool School Girls)*

Again, the use of advanced technologies in food was perceived to be posing regulation and safety issues. Following the BSE (mad cow disease) crisis and participants' experiences with organic food, there was wide mistrust in the integrity and adequacy of institutional regulations, and doubt in experts and industry's report and assurance of safety. Furthermore, these advanced technologies were perceived to be going beyond the ethical and moral boundaries of science and posing sustainability threats.

In summary, there was the certainty that the innovative services and technologies in food had brought a lot of benefits. Nonetheless, the people did not rule out the fact that, there is also a price to pay for these gains. Such early lines of thoughts provided multifaceted planes in terms of how the people are likely to engage with biotechnology (particular agricultural GMOs), highlighting salient discourses such as: safety, trust, naturalness, questions of justification, and perceived autonomy and acceptable ethical boundaries of science.

6.3 Public response to institutional framing of GMOs in the UK

Technologies cannot be represented as neutral scientific artefacts. Thus, technologies are always framed and represented in specific ways, and for predetermined and specific purposes (Macnaghten et al, 2019). Framing a technology involves considering the current and future intended purpose(s) of

the technology and the benefits it holds for society or the intended social context in which it would be embedded (Macnaghten, 2020).

Given that the public are unfamiliar with emerging technologies in terms of their conventional definition and the social and ethical issues they pose, I argue that, how the public response to the institutional framing of an emerging technoscience is also crucial in predicting the wider spectrum out of which public responses are likely to emerge from. In the UK, in an attempt to further extrapolate which clues are salient in understanding and determining the responses of the people to GMOs, the participants were asked to respond to a balanced report – that reported on how institutional systems (particularly government, industry and NGOs) frame the technology. The framing by industry and government includes: 'Biotechnology is one way to cut down the amount of pesticides', and 'GMO is food for the future'. Surprisingly, most of the participants expressed doubt in these romantic framings. The focus of the discussion was sharply turned from the technical functionality and the promises embedded in industry and government's narratives. Instead, much of the discussions were centred on trust, motivation behind the use of the technology, and to the perceived institutional deficiencies in governance and regulation of the technology.

For most people, they have lost trust in the government, following past failures of government and expert systems in governing science and innovations. In an attempt to justify this, the BSE crisis was drawn on to express the ever failure of government to protect the safety of the public and the lethal flaws that exist in institutional systems responsible for the governance of science and technology. Such conception bred the feeling that the technology was pursued at the expense of the public. Generally, government and industry were considered as holding romantic ideas about emerging technologies. Thus, how they frame the technology was seen as misguidedly and guilefully structured to cause the public to fall in love with the technology. In like manner, reports on the technology by NGOs, including Greenpeace was considered as uninformed, misguided, and selfishly structured. Some participants said:

> *Female:* *This... they are manufacturing the product; they will want people to buy it. So, they are going to say that it's brilliant. So, it's not very sort of trustworthy is it, to make an Informed decision on it.*
>
> *(UK Group 1, Blackpool School Girls)*
>
> *Female:* *Well we don't trust the government; we don't trust independent names... and we don't trust the people who are producing it.*
>
> *Female:* *...They've got their own angle, their own agenda to go along with so it's not necessarily just because Greenpeace say it doesn't necessarily mean that it's right.*

Interestingly, the term 'biotechnology' was perceived to be deliberately crafted and used to blind public eyes from the risks and uncertainties that the technology poses to society. To sum up, in the UK, there was a wide mistrust in government and expert systems involved in the development and governance of the technology, due to institutions' past behaviours. Again, based on people's experiences with scientific endeavours in the past, they seemed to have lost confidence and interest in modernity. Such responses to the institutional framings consolidate and solidify the early clues that was shown to structure how public response to genetic modification would later be configured in the discussion.

Obviously, this provokes a question, which is: if the people are not drawing upon and signing up for the enlightenment narratives [which underpins the institutional framings], what counter-narratives may be present in public discourses on the technology in the UK? To answer this question, I have developed five (5) key cultural narratives particularly useful in structuring and understanding the responses of the people to the technology. These narratives were recurrent themes that were configured and sometimes reproduced in a different form in the discussions. In what follows, I discuss each of these narratives in turns.

6.4   The cultural narratives salient to understand public response to GMOs in the UK

6.4.1   Be careful what you wish for

The 'be careful what you wish for' narrative was extrapolated from a very old story. The narrative emphasizes the idea that, getting all your wishes met may lead to unforeseen future consequences and calamities, especially when these wishes are meant to gratify one's selfish desires. The moral lesson underlying this narrative is probably one of the most ancient Western wisdoms and humankind in general, because of its critical reflection on the 'relationship between human desires and human good' (Dupuy, 2010: 155 cited in Macnaghten et al, 2019: 510).

Dupuy shows the different ways in which the price of boundless desires has been recounted in European thinking, including literature, philosophy, song, folklore, film, and poetry. He particularly examined how the 'Three Wishes' folk tale as narrated by Grimm brothers was embedded and reproduced in almost every European culture. In his narration, he discusses three elements. First, there is the granting of three wishes, that represents the boundless desires. Second, there is the silliness of the first wish, representing the 'chasm between everything that could be wished for and a trivial and mediocre whim or caprice' (Macnaghten et al, 2019: 510). Third, there is the trap, the regret of the first wish and the desire for a second wish imagined under the influence of vexation, insults and even

violence and which can be removed only by a third wish. The ultimate result is the paltry satisfaction. In general, this narrative describes the ridiculous logic of unbounded desire and of the restoration of the 'virtues of everyday practices and relationships, such as family, marriage, community and being proximal to nature' (Macnaghten et al, 2019: 510).

In the UK focus group, this narrative was recurrent in the discussions. For most people, the romantic ideas ('Biotechnology is one way to cut down the amount of pesticides', and 'GMO is food for the future') that are used to represent genetic modification was seen as a deliberate effort by government and industry to beguile the public. And the quest to gratify this fallacious desire was thought to lead to unforeseen consequences and catastrophes. One participant drawn on smoking to explain the dangers of having boundless desire. The participant expressed that, in people's quest to have a relief, they engage in smoking. However, granting such desire (the desire to have a relief) by smoking, inevitably comes with future consequences and complications.

Similarly, the ferocious impact of nuclear energy on society were seen as an analogy for genetic modification. That is, government represented nuclear energy in a particular seductive way, however, granting such desire (using nuclear energy) has brought a lot of calamities in society. Generally, emerging technologies, including GMOs were considered to be driven by logics of neoliberalism, which can further deepen micro economic and political inequalities. This narrative was deployed in the discussions particularly to critique discourses aimed at romanticizing emerging technologies.

> *Female:* *When you get, I mean I don't know whether it's a comparison or not, but you know people smoked cigarettes and thought it was cool and thought it was de de de. And it's only as there's been research from lots of different angles that people have realised that may not be the case anymore.*

> *(UK Group 5, Young Mothers)*

6.4.2   Messing with nature

A close variant of the 'Be careful what you wish for' narrative was the 'messing with nature' narrative. This narrative, that holds that emerging technologies have the potential to interfere with nature, is embedded in ancient discourses that present nature as possessing unique qualities and characteristics that defines the order of natural interaction (cited in Macnaghten et al, 2019). From a more theological perspective, nature (God) is thought to have defined the moral and ethical boundaries that man should not go beyond and how living organisms (including plants) should reproduce – after its own kind. Such discourse emphasizes the need for man to operate within the acceptable moral and ethical boundaries determined by nature.

This narrative was salient in the UK focus group discussions, as most people deployed it to explicitly point out the potential down sides of emerging technologies that were imagined transgressing the moral and ethical boundaries set by nature. In the discussions, emerging technoscience in general – particularly in the domain of food and medicine was considered as a way of playing and competing with nature, because of its perceived association with disruption of natural orders and boundaries. Such line of discussion led many people to frame GMOs as 'unnatural', and its use was thought to pose sustainability challenges.

> Male: Yes, it's not natural, because as I say you're tampering with nature. It's not, it shouldn't be done.

> *(UK Group 3, Preston Fathers)*

Besides, this narrative was also deployed to extend the debates and scholarships on ecological justice. Genetic modification was not only seen as tampering with nature; it was also seen as a way of discriminating against organisms of the same kind and species. Theory of ecological justice – the idea that all living organisms (including plants) should be treated fairly was used to critique the potential impact of the technology among species. The argument here is that: why should some species of the same kind be genetically modified while others are not? The modification was perceived to inherently exclude some species (genetically modified species) from natural processes.

6.4.3   Dr Strangelove narrative

'Dr Strangelove' is an old film that ridicules the Cold War fears of a nuclear conflict between the United States and the Soviet Union. The story is about an American Brigadier who almost put the world on the verge of a nuclear calamity, when he deploys a B-52 bomber on the Russians without any consultations with his superiors. The film, which was produced in UK, plays the situation for laughs. Particularly for the UK focus group discussions, this narrative provides a historical resource for understanding the response of the people to GMOs. In the discussions, responsible governance and regulation of emerging technologies appeared to be a major concern.

Even though there was the assertion that GMOs hold enormous benefits, nonetheless, there was the feeling that the technology cannot be governed and regulated well – to mitigate any unforeseen consequences. For most people, once the technology is embedded in society, institutional systems will not take the moral responsibility to ensure how people engage with the technology's wider reach. Generally, people felt that when a new technology gets to the public domain, it has a life of its own. Thus, it becomes difficult to determine and regulate who use it, how they use it, and what they use it for. Based on this, there was the feeling that expert systems have in the past failed to governed and regulate new technologies for sustainability purposes.

Again, such line of thought led to the concern that, some 'evil' people will use the technology to serve their selfish interests and gains, which was seen to bring catastrophes. Some participants said, like cloning, it was bore out of good intentions and for public good. However, it was later corrupted and manipulated by evil people to advance evil purposes.

> Male: *And cloning the same kind of thing to do with a shortage of organ donors. One of the original notions with cloning was that you could genetically reproduce organs that would save people's lives. But then you start getting into the Frankenstein scenarios of like cloning people's heads and those images of that ear on the back of the poor mouse. So once things are in the public domain, they're difficult to…*

> Male: *Yeah, well, once things are put into the public domain it's very difficult to police things. And I genuinely believe as well that something like cloning, you know, the first guys who actually clone the first liver and save someone's life probably thought oh, God, this is fantastic. May not have even thought, you know, fifteen years down the line what the possibilities might be.*

> *(UK Group 6, Manchester Singles)*

In general, this narrative was not necessarily used in the discussions to oppose emerging technologies. Rather, it was deployed as a historical resource to point eyes on institutional past failures and what happens when technologies are not paired with formal institutional moral responsibility.

6.4.4 Kept in the dark

The 'kept in the dark' narrative was also a salient and unique narrative particularly in the UK focus group discussions. The 'kept in the dark' narrative is kind of story that is deployed to express a sense of exclusion in a technology development trajectory – particularly when people feel that they have been left uninformed about the existence and potential of a particular emerging technology (Macnaghten et al, 2020). It is shown that the narrative has two distinct but interconnected variants: either that an emerging technology is being controlled by institutional systems and where the wider local populations are purposefully alienated and 'kept in the dark' or an emerging technology is inherently political (Macnaghten et al, 2019).

For the UK publics, the 'kept in the dark narrative' was used to explicitly express a sense of lack of agency and disconnection from the processes which were developing the technology. Generally, people felt uninformed, powerless, and unfamiliar with the technology. This bred a lot of mistrust in government and institutional reports and suspicions that government was deliberately keeping salient information from the public. The BSE crisis was drawn on to justify why government and other expert systems were considered to be devious and untrustworthy.

> Male: *Biotechnology's got bugger all to do with that. There are people who you can't connect with and you've got no kind of control over that are driving that.*

Female: ...But at the moment we are not being given the information to make the right choices, are we? Because the government is frightened.

(UK Group 1, Blackpool School Girls)

Male: ...Yes, because you can't trust them. The example to that is BSE.

(UK Group 3: Preston Fathers)

6.4.5   The rich get richer

The 'rich get richer' is the last narrative was deployed in the UK focus group discussions. This narrative is one of the dominant discourses underlying social science scholarship on technological driven development and modernity. Again, this narrative is one of the major discourses underpinning Neo-Marxists' critique of modernization – particularly the Green Revolution. This narrative is premised on the argument that, emerging technologies which are often times associated with the promise of good and benefits, also have the potential to deepen the existing socioeconomic and political inequalities - both at the micro and macro level. The 'rich get richer' narrative is salient when it is deployed to explain the logic of the North enjoying all the benefits associated with emerging technologies while the South is left behind, or alternatively, multinational businesses benefiting enormously from emerging technologies while the poor is economic and political marginalized (Macnaghten et al, 2019).

The narrative was specifically used in the discussions to explain how emerging technoscience are inextricably entwined with the logics of neoliberalism, which inevitably produces a capitalist political economy. GM technology was seen to only benefit rich agribusiness companies and big organizations who are involved in the development and commercialization of the technology. This knowledge was followed by questions about morality and justice, as consumers (the wider public) were perceived to be excluded from the potential benefits of the technology. The key concern here has to do with the potential of the technology to promote economic inequalities at the micro level, and the moral justification for the technology when it is not intended for public good.

Moderator: So, whose benefit are they operating in do you think for whose benefit do you think then?

Female: For the people that are already rich.

Moderator: People who are what?

Female: People who are already rich, because they are making them put money into the thing, into the companies and gain more money out of them because...

6.5   Conclusion

In summary, in the UK, public response to GMOs was structured by lack of trust in government, a sense of alienation from the processes developing the technology, meanings and purposes of technology, transgressive ability of technology, questions of equity, limitations of science, and to the perceived lack of formal institutional moral responsibility to responsibly govern the direction of innovations. These responses mirror the early clues that was shown to structure and shape the response of the people to the technology. In the next chapter (chapter 7), I aim to explore and understand the Ghanaian public's response to GMOs. This analysis will set a common basis for the comparative analysis of the two groups, in the subsequent chapter.

<center>**Chapter Seven**</center>

<center>**Public Response to Emerging Technology in Ghana**</center>

7.1   Introduction

This chapter (chapter 7) presents the analysis of the focus group discussions held for the groups in Ghana. Like the analysis of the UK group (in chapter 6), I do not aim to make an all-inclusive analysis. Rather, I have focussed my effort on the recurrent thoughts that were central in all the discussions. In so doing, all the salient threads that ran through the discussions are methodically and meaningfully reproduced in this analysis. Besides, in this chapter, I have made several moves which are aimed at setting a common ground for the subsequent comparative analysis of the two groups. I will set out this analysis by first: understanding the context in which GMOs are embedded and the key factors that are likely to shape the response of the people to the technology. This will be followed by an examination of the people's response to how expert systems (particularly government and industry) in Ghana frame the technology. Moreover, I will identify and discuss the key cultural narratives that are salient to the public in Ghana, when engaged in conversations on the technology.

7.2   Context and factors likely to shape public response to GMOs in Ghana

In the previous chapter (chapter 6), it was discussed that the publics are unfamiliar with emerging technologies in terms of their mainstream definition and the social and ethical issues they pose. Following this, I argued that, such assumption evokes the need for public understanding of science (PUS) analysts to explore and understand the context in which an emerging technology is embedded and out of which public responses are likely to stem from. Macnaghten (2020) shows that, one way to realize this, is for a PUS data analyst to explore and understand the relevant everyday experiential practices related to the technology.

In Ghana, the selected context was everyday food practices and role of technoscience in food. It is argued that, how the public response to the use of techniques of agricultural biotechnology – particularly GMOs, in many part depends on their perceptions about food in general and the desirable role they ascribe to the application of science in food (Grove-White et al., 1997). The focus group discussion began by first exploring from participants point of view, what changes in food they have observed in Ghana in the past decade. The deliberation further engaged the people in exploring whether these changes are good or bad. The discussion then took turn by examining the perceived desirable role of science and technology in food.

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The discussions on food was informative, as participants enthusiastically expressed ambivalent attitude towards recent changes in food. Generally, food appears to be an important and interesting subject to the participants because it is an experiential everyday practice. The people expressed that, there has been a lot of positive changes in food in recent times. The emergence of fast food and international variety was shown to have brought convenience and helped save time. Also, they identified that there has been an improvement in packaging of food, which has helped to make food more portable and appealing.

Despite these positive changes, there were several concerns: first, the emergence of fast food was seen to have increased the use of artificial (chemical) preservatives in food. Second, the emergence of fast food, coupled with greater international variety was considered to have impacted local food culture and food sovereignty negatively, as people expressed displeasure and reservations for the high preference of Western foods over local foods. Food was considered not only as a substance, but also as a cultural element, with a cultural significance. Such understanding of food (as a cultural element) provoked many questions, as some of the changes were seen to be gradually eroding local food culture and habits. Some participants said:

> *Female: Now we are adapting to their food culture, making us leave our local foods we have in the system.*
>
> *Male: If we adapt to some of these foreign foods and develop a taste for these foreign foods, instead of our local foods, a generation will come and show higher taste and preference for these foreign foods.*
>
> *Male: So, it will get to a time where our local foods which is part of our culture as Ghanaians would be no more.*
>
> *(Ghana Group 2, Social Science Students)*

Furthermore, the people felt that the convenience that they have gained in food recently, has also increased the number of food fraud. This led many to express doubt in the efficacy of the regulatory institutions to regulate the recent changes in food to protect consumers. A participant speaking in this direction said:

> *Male: Sometimes you go the market and you see a product labelled 'low in sugar'.*
>
> *Male: You buy it and later when you are using it, you will realize the product contains a lot of sugar.*
>
> *Male: And we claim that we have regulatory bodies, yet we have a lot of frauds out there.*
>
> *(Ghana Group 4, Physical and Agricultural Science Students)*

To sum up, the participants found themselves in a dilemma. Although recent changes in food has brought benefits, there were also the assertions that there are prices to pay - in terms of food quality and safety, preservation of culture, and to the threat it poses to autonomy and food sovereignty.

Following this dilemma, people were then asked about the role of science and technology in navigating these externalities. Surprisingly, the people digressed from the focus of the question and discussed their ambivalence over the role science in food. This, I infer, may be due to the pluralization of recent debates concerning the desirable role of novel science in food. Generally, there was ambivalence over the potential science and technology holds in food. This ambivalence the people spoke of, consolidates with the dilemma they identified when it comes to recent changes in food.

To be more precise, there was consensus that the application of science and technology has helped to boost productivity, brought convenience and extended the shelf-life of food - through improved farming methods, processing, improved packaging, modern storage facilities and the use of chemicals, including: preservatives, fertilizers and pesticides. However, the use of science and technology in food was also thought to be inevitably making food unnatural, unsafe, and posing health risks. There was the realization that there are side effects which are inextricably intertwined with the application of advanced technologies, which are not built on principles of 'green' alternatives.

What is more, following the failure of expert systems to enforce regulation laws in the past, these externalities were seen to be emerging from lack of institutional commitment and efficacy to responsibly govern science and innovations for sustainability purposes. These lines of the early discussions gave clues to the multiple lenses that the people's responses to genetic modification would emerge from and be configured, highlighting the salient discourses of safety, trust and institutional efficacy, independence and food sovereignty, and to the perceived justification of the technology.

7.3   Public response to institutional framing of GMOs in Ghana

As discussed in chapter 6, technologies cannot be represented as neutral scientific artefacts. Thus, technologies are always framed in specific ways and for predetermined and specific purposes (Macnaghten et al, 2019). Again, framing a technology involves considering the current and future intended purpose(s) of the technology and the benefits it holds for society or the intended social context in which it would be embedded (Macnaghten, 2020).

Given that the public are unfamiliar with emerging technoscience in terms of their conventional definition and the social and ethical issues they pose (Macnaghten, 2020), how the public conceptualize the romantic ideas experts frame emerging technologies with, is crucial in predicting

the variety of planes public responses are likely to emerge from. I draw on this understanding, to exploring into details which clues are salient in structuring the responses of the people to GMOs. In the Ghana groups, the participants were asked to respond to a variety of institutional framings, including: 'GMO is safe', GMO offers potential to easily modify local crops', 'GMO helps to control pests and diseases in a sustainable manner', and 'GMO helps to increase yield'.

A very few of the participants spoke in assertion of these enlightenment narratives. Even so, these few persons were more ambivalent over the potential down sides of the technology and the ability of the regulatory systems to responsibly govern the technology. In every group, the discussion was turned from the potential of the technology to the motivation behind the use of the technology, the institutional context in which the technology would be embedded, and to the socioeconomic issues, including: impact of the technology on human health, agricultural independence, food sovereignty, biodiversity, and seed system.

Generally, the discussions resonated the argument that, emerging technologies (including GMOs) are not inanimate objects that would inherently lead to good once adopted, as romanticized. People focus on disentangling the socioeconomic and ethical issues and the trade-offs that are likely to come into play in the uptake of the technology. This does not posit that the people viewed GMOs in an entirely negative light. Rather, it shows that people were more concern about knowing the moral justification, estimating the neglected unforeseen consequences and risks, and assessing the efficacy of expert systems to mitigate unforeseen consequences and catastrophes.

Such discourses reinforce and crystallize the early clues that was shown to structure the formation of public opinion about GMOs. The question now is: if people are not drawing upon and signing up for the romantic and enlightenment narratives, what counter-narratives may structure public discourses on the technology in Ghana? To answer this question, I have developed five (5) key cultural narratives particularly useful in structuring and understanding the responses of the people to the technology. These narratives were recurrent themes that were configured and sometimes reproduced in a different form in the discussions. In what follows, I discuss each of these narratives in turns.

7.4 The cultural narratives salient to understand public response to GMOs in Ghana

7.4.1 Be careful what you wish for

As explained in the previous chapter, the 'be careful what you wish for' narrative was derived from a very old story. The narrative communicates the idea that, having all your desires met may inevitably give rise to a distinctive new set of challenges and calamities, especially when these wishes are not legitimate and meant for public good. Even though this narrative has a more western antecedent, the moral lesson from the narrative is also deeply rooted in African adages and proverbs that teach contentment. For example, like this narrative, the African proverb, 'He who runs after good fortune runs away from peace' was a salient cultural resource in understanding the responses of the Ghana group to emerging technoscience.

In Ghana, this narrative was deployed to convey the impression that, the romantic ideas experts (particularly industry) use to represent agricultural biotechnology, is as a deliberate and guileful way to cause the government to fall in love with the technology and lure her into accepting it, even when the technology is inextricably entwined with unforeseen consequences and catastrophes.

Skin bleaching was an analogy for GMOs. One participant said that, skin bleaching was represented in a seductive way and with good promises (to give white and nice skin). However, some women in their quest to grant this desire (have white skin) suffer complications and consequences in the future.

For many people, even though the technology is presented on good promises, any attempt to grant such desire (use the technology) will inevitably pose risks (lead to erosion of local varieties and food culture, deepen the existing economic and political inequalities between the North and the South, and drum out local ingenuity and entrepreneurialism). Generally, this narrative was sourced to critique modernity and expressed the need to harness local capacities in a developmental process.

> Male: *This GMOs is more or less like how some women introduce certain chemicals onto their skin to bleach it. At the end of the day these women suffer a lot of complications.*
>
> Male: *For me anything artificial comes with a side effect. Sometimes it takes time to identify them.*
>
> Male: *So for me this GMOs is the same as a woman bleaching her skin.*
>
> Male: *So if we introduce a foreign gene to another organism then we should know that we are trying to cause complications.*
>
> Male: *Just that with the GMOs the effect may not be instant like that of women who bleach.*
>
> *(Ghana Group 4, Physical and Agricultural Science Students)*

7.4.2 Pandora's Box

A close variant of the 'Be careful of what you wish for' is the Pandora's Box. The story of the Pandora's Box is a familiar one, both in the Western and African setting. The story shows a closed box that releases the sweep of human evils, if opened. The story is about Pandora, the first woman who was given a huge jar and was instructed not to open it. In her quest to know what is in the jar, she opened the lid and all the sicknesses and diseases, sufferings, and evils that mankind has been spared from, came and infected the world (cited in Macnaghten et al, 2019).

This story is a myth that aims to explain why the world is filled with evils and miseries. In the focus group discussions, this old story provided a linguistically resource for understanding why the participants kept saying that genetic modification is risky and a misguided effort. For most people, the technology will give rise to new kind of distinctive social and ethical challenges if embedded in society. The argument here was that GMOs hold enormous potential for the future, particularly for the South. However, considering the besetting institutional climate, the technology was seen to bring calamities if used. People felt that government and regulatory systems have in the past failed to stringently enforce regulation laws to protect consumers' safety and choice.

This narrative was further configured in the discussion by a demonstration of a wide mistrust in the efficacy of regulatory institutions, following the lack of enforcement of full and explicit labelling laws and the recent currency food fraud and safety issues has gained. These lines of arguments were deployed to consolidate the claim that the technology is dangerous and ill-considered and will inevitably lead to calamities that cannot be mitigated.

> Male: *We won't even be able to identify GM foods in the first place.*
>
> Male: *How many of the food commodity at the local markets are labelled?*
>
> Male: *Sometimes it is very difficult to distinguish between inorganic food products and organic food products. And we say we want to adopt GMOs.*
>
>
> Male: *Adopting this GMOs is very dangerous because of the kind of regulatory institutions we have here in Ghana.*
>
> Male: *You know I feel sometimes the approvals FDA gives approval to companies without assessing their products properly.*
>
> Male: *It is all about money. Because some of these products don't go through the rigorous processes before they are approved by FDA.*
>
> Male: *You know sometimes there are products that are approved by FDA and it later comes out that the products are not good.*

> *Male:* *The key question is how did those products find their way into the market with FDA signs on them?*

> *Male:* *It's difficult to trust our regulatory institutions. GMOs is 'no' for me.*

> *(Ghana Group 4, Physical and Agricultural Science Students)*

7.4.3 Messing with nature

The 'messing with nature' narrative was an important narrative in the discussions. This narrative, that holds that an emerging technology has the potential to interfere with nature, is embedded in ancient discourse that presents nature as possessing unique qualities and characteristics that defines the order of natural interaction (see Macnaghten et al, 2019). From a more religious perspective, nature (God) is thought to have defined the moral and ethical boundaries that man should not go beyond and how living organisms (including plants) should reproduce – after its own kind. Such discourse emphasizes the need for man to operate within the acceptable moral and ethical boundaries determined by God.

The 'messing with nature' narrative appeared to be salient and of great concern to the participants, particularly because of the religious orientation of Ghana - it is dominated by practicing Christians. To be more precise, the people's faith (in God) and reverence for God made them to deploy the 'messing with nature' narrative to demonstrate the potential pitfall of GMOs in defying the natural and moral orders set by God. According to one participant, all plants (crops) have a fixed characteristics and inherent growth processes which is set by God. So, any attempt to modify a plant was considered as a way of breaking God's order. This was seen to evoke God's wrath, leading to consequences and catastrophes. The narrative was later configured in the discussions to frame genetic modification as 'unnatural', 'artificial' and 'risky', because of its perceived potential to break God's order.

> *Male:* *In God's original intention there are certain things that are supposed to function in the crop system. So, when you bring in other stuffs it will alter the natural genetic composition and structure of the organism.*

> *(Ghana Group 1, Business Students)*

> *Female:* *I want to find out whether it will have any significant effect on the crop.*

> *Female:* *Because the crop was made by God to take the structure and the texture it has.*

> *Female:* *So, we using that GMOs are we not going to change structure and the texture of the crops?*

> *(Ghana Group 2, Social Science Students)*

Female: *...I think we should find ways of irrigating the land rather than this idea of trying to insert something into the seeds to interfere with the natural ways' crops behave and grow.*

Female: *Interfering with nature is not good. And it will always come with a consequence.*

(Ghana Group 3, Humanities Students)

7.4.4   The rich get richer

The 'rich get richer' was also a salient and recurrent narratives in the discussions. As previously explained, the narrative is one of the key social science resources deployed by Science and Technology Studies (STS) and Social Science scholars in critiquing technoscience endeavours and modernity. This narrative is premised on the idea that, emerging technologies which are often romanticised by expert systems, also have the potential to deepen the existing socioeconomic and political inequalities both at the macro and micro level. The 'rich get richer' is salient when it is deployed to explain the logic of the North enjoying all the benefits associated with emerging technologies while the South is left behind, or alternatively, multinational businesses benefiting enormously from emerging technologies while the poor is economic and political marginalized (see Macnaghten et al, 2019).

The people deployed this narrative, which is embedded in theory of justice, to express the feeling that the use of GMOs will benefit transnational seed companies in the North, at the expense of local farmers. There was a concern that, GM agriculture would lead to corporate control of the seed system. Such development was seen to only benefit the rich actors (big seed companies) who are involved in the development of the technology.

Besides, this narrative was deployed to express the feeling that if the technology is commercialized in Ghana, only the few commercial farmers will have access to the technology and benefit from it. The argument here was that Ghana's agricultural system is dominated by smallholder farmers, of which majority of them reside at the rural areas. These smallholder farmers were perceived to have serious challenges in accessing agricultural innovations and services. This led many people to question how smallholder farmers are going to benefit from the technology, considering how government has in time past failed to prioritized and neglected them in developmental programmes.

In the discussion, this argument resonated the feeling that the technology would be met with neoliberal logics and thus, will inevitably promote capitalist political economy. These discourses evoke the existing social science scholarships that rely on narratives of social justice and equality to critique modernity (see Jasanoff, 2002).

> M: *Because if we adopt the GMOs the farmers planting materials would be in the hands of the big foreign seed firms.*

> M: *You know these firms can exploit the poor farmers if majority of farmers show interest in the GM seeds. They will monopolize our seed system and take advantage of our farmers.*

<div align="right">(Ghana Group 1, Business Students)</div>

> M: *It is obvious that farmers are going to benefit from the GMOs when is accepted.*

> M: *But you know in Ghana when policies are introduced mostly it is those in the urban areas or the commercial farmers who will benefit.*

> M: *So, it is possible that the smallholders who are mostly in the rural areas are not going to benefit.*

<div align="right">(Ghana Group 2, Social Science Students)</div>

7.4.5   The colonisation narrative

The 'colonization narrative' is the last narrative that was identified in the discussions. This narrative is a familiar one, particularly in South. Colonization expresses the historical event where the North invaded the culture of the South and established political control over them. Since the time colonies gained independence and freedom from their colonial masters, there have been massive efforts to reinforce their political independence. The 'colonization' narrative underscores the substance in colonization. Basically, this narrative is hanged on the idea that emerging technologies have the potential to spread out and eventually colonize the autonomy and agency of people.

In the discussions, there was the idea that the technology cannot be locally owned, so its adoption would ultimately make them dependent on the West. In making reference to the colonial era, people felt that the West will use the technology as a bait to colonize their autonomy and agency – by way of dispossessing them of the power they have over their food system and choice.

This narrative, which is inextricably intertwined with meta economic and political injustice, was deployed to show a wide mistrust in 'Western' modernity, following the indelible harm caused to the South through colonialism. Furthermore, this narrative is particularly salient, as it shows the idea of people in the South deploying historical resources to critique the potential of emerging technologies.

> Male: *They are saying that when we adopt this GMOs, we are going to get a lot food and a whole a lot.*

> Male: *A time will come where we would be solely dependent on them.*

> Male: *Which will in some way reinforces colonialism.*

Male: Personally. I think that anything that these people bring here, they their own agenda behind it.

(Ghana Group 2, Social Science Students)

Male: You know if we are using these GMOs, majority of the GM seeds will come from outside.

Male: So, with time, the foreign seed companies will be in control of our food and they will dictate to us. And we will be like slaves to them. I think before we expose ourselves to GMOs.

Male: And then I also think that it will get to a time where they would dictate to us what we have do.

(Ghana Group 4, Physical and Agricultural Sciences)

7.5   Conclusion

To summarise, in Ghana, public response to GMOs was structured by perceived absence of institutional capacity, questions of equity and ownership, limitations of science, meanings and purposes of technology and to the perceived transgressive ability of the technology. These narratives reflect the early clues that was shown to structure and shape the response of the people to the technology. In the next chapter (chapter 8), I aim to discuss into details the analysis in this chapter and that in chapter 6, by comparing the narratives that were deployed by the publics in both national contexts and how these narratives appeals to the enlightenment master narrative of science and technology.

<p style="text-align:center">Chapter Eight</p>

<p style="text-align:center">Comparative Analysis of Public Response to Emerging Technology in the UK and Ghana</p>

8.1   Introduction

In chapter 6 and 7, I presented the counter narratives that the publics in the UK and Ghana draw on when engaged in deliberations on GMOs. Overall, there discussions were enlightening and informing as people express distrust in the enlightenment master narrative of science. The feeling of ambivalence over the potential of GMOs and the variety of the counter narratives that were mobilized in all the discussions, bring to light that people did not hold predetermined or fixed opinion about science and technology. Rather, these diverse reasoning strategies – by analogy or inference (as shown in the analyses) were deployed as a linguistical resource to critique modernist narrative of science and render innovative technological developments culturally and meaningful.

Importantly, this points out the ability of the public to openly and fair-mindedly deploy and meaningfully structure everyday experiential practices to assess the risks and uncertainties that emerging technologies pose. Such assessment may not necessarily be true and reliable but broadly, it gives clues to the socio-economic and political factors that are missing from traditional and dominant technological risks assessment processes.

All the same, this does not imply that people outrightly view technoscientific endeavours in an entirely negative light. They do. For example, for the Ghana group, people spoke in assertion of the enlightenment thinking that were underpinning the institutional framing. However, giving the institutional context and the real-world conditions driven by 'free market' that emerging technologies are embedded, people rarely express trust in technological development, for fear that it will lead to disaster.

8.2   Comparison between the responses of the public in the UK and Ghana

In each group (the UK group and Ghana group), the narratives initially emerged as individual contributions but later appealed to others and were configured in the discussion as a collective resource to structure and reflect the overall group effects and vocabulary. In the same vein, in each group, the narratives were not expressed as independent discourses. Rather, they were interconnected and meaningfully functioned together, with a central thematic framework – unique to each group. That eventually brought the key distinction between the two groups.

Generally, the responses in both groups were more dreadful and calamitous, with a collective expression of lack of confidence in scientific innovation. By way of comparison, there were a substantial number of common narratives that were deployed by both groups, including the 'be careful what you wish for' narrative, 'messing with nature' narrative, and the 'rich get richer' narrative. Nevertheless, these narratives were deployed for varying purposes and were configured differently in each group.

In the UK, the people's lack of confidence in their government following the government's tragic regulation oversight of science and innovations in time past, appeared to be the origin and central theme of the narratives. This accounted for the repeated and consistent deployment of resistant narratives of past failure of technoscientific developments. Such understanding led to the feeling that it is imprudent and dangerous to fall for emerging technologies on the ticket of the seductive narratives use by government to represent them (emphasising the 'be careful what you wish for' narrative). Consequently, novel technologies were thought to inevitably lead to disaster because government would not take moral responsibility for its governance (emphasizing the 'Dr Strangelove' narrative).

Again, It was against this same background that resonated the idea that technologies are embedded in the logics of free market, the neoliberal social policy and thus, the benefits are unfairly distributed – with rich multinational companies benefiting at the expense of the local populations (emphasizing the 'rich get richer' narrative). These narratives were later characterised by a strong feeling of powerlessness and alienation from the processes developing the technology (emphasizing the 'kept in the dark' narrative).

The stories in Ghana were quite different, even with the common narratives. It was not surprising that in Ghana, the overall response of the people were centred on deterioration of the regulatory systems [dominated by lack of enforcement of regulatory laws] and lack of institutional capacity to own and govern emerging technologies for sustainability purposes. This, I argue, could be due to the fact that the regulatory system is not robust and effective, and experts involved in regulation of novel science in Ghana have little experience in governing emerging technoscientific endeavours.

Contrary to the stories told by the UK group, among the Ghana groups, the perceived lack of institutional capacity gave birth to the ideas that novel technology such as GMOs will constitute a distinctive kind of governance challenges and thus, inevitably leading to catastrophes.

The argument here was in two folds: first, it is dangerous to wish for something (here, fall for 'Western technologies') if you do not have the [institutional] strength to manage it (emphasizing the 'be careful what you wish for' narrative); and second, having a wish (a technology) that you cannot

take care of (or responsibly govern) granted will lead to calamities (emphasizing the Pandora's box). In addition, these logics were followed by a sense of lack of ownership, which informed people that novel technologies come from the West and will serve the interest of the powerful actors (rich multinational companies at the West) who are involved in its development and the few rich users (commercial farmers) who can afford and have access to the technology, while the 'poor' (smallholder farmers) is marginalized (emphasizing the 'rich get richer' narrative). This evoked a salient thinking that if the technology cannot be locally owned, then the North will eventually colonize their agency and autonomy and the food system (emphasizing the 'colonization' narrative).

Furthermore, the 'messing with nature' narrative also holds the same dynamics. The discourse embedded in the images of science transgressing the moral and ethical boundaries of nature, or science getting out of control, or scientists abusing their power and playing God was deeply rooted in the cultural values of the people, across the two nationals. Nevertheless, the line of configuration was different in each group. For the UK group, references to 'nature' was repeatedly deployed to serve the purpose of linguistically identifying the distinction between the moral and ethical boundaries of nature and the ecological disasters that arose when science transgresses such boundaries. Also, a close argument that was also mobilized has to do with ecological justice – the idea that advanced technology like GMOs has the potential to excluding some species from benefiting from natural order and processes.

In the case of the Ghana group, by contrast, the rhetoric was different. Because Ghana is a Christian state, GMOs were considered as a way of violating religious belief and values and disregarding God's standards. God was seen to have pre-defined humans' interaction with nature and thus, going beyond what is already set is an act of disobedience to God, and shall come with consequences.

8.3   Conclusion

To summarise, the responses of the UK publics to emerging technologies were like that of the Ghana group, with key distinctive political culture differentiating between the lines of the argument and rendering them culturally meaningful. In the UK, the people are generally were not enthused over science and innovations and has refused to sign up for modernity because of their distrust in government, coupled with corrosive oversight of technoscientific developments in the past.

In the context of Ghana, emerging technologies (including GMOs) were met with a cataclysmic response like the UK public. Generally, people felt that the regulatory frameworks are impotent. Thus, emerging technologies like GMOs cannot be managed by the institutional systems to mitigate the socio-economic and political issues they pose. Not surprisingly, in Ghana, the alignment of an

emerging technology with religious belief appeared to be a salient consideration in public technological assessment processes.

In all, the commonalities and differences between the responses of two groups to emerging technologies hang on lack of institutional experience and past institutional failures. Particularly for the Ghana group, the absence of institutional experience in terms of governance of advanced technoscience gave birth to scepticism and distrust in expert systems, leading to the production of the distinctive narratives. In contrast, in the case of the UK, even though expert systems have substantial experience in governing novel science and technology, such experience was soiled with failures. This accounted for the distinctive narratives and discourses that were deployed to critique technological innovations and development.

Such findings differ remarkably from dominant studies that prejudice against public's risks perception and opinion forming processes. Obviously, this shows that public responses to novel science and technology, in most national contexts, are seldomly expressed in simple 'distributional terms', of tapping the potential benefit of technology while minimizing its externalities (Macnaghten et al, 2019). Rather, the narratives that were mobilized by the publics at both national contexts point to the persistent non-alignment of innovation trajectory with societal values, lack of consideration of the social and regulatory context in which technology is embedded, failure to couple modernization policies and programmes with moral responsibility, and lack of conceptualization of the cultural meanings and purposes of technology.

In the chapter that follows (chapter 9), I will discuss the key policy implications that can be drawn for governance of controversial science and technology.

Conclusion, Implications and Recommendations for Policy Making

9.1 Implications and Recommendations

An implication for policy making, probably, will stem from the novel upstream governance approach that these findings (as discussed in chapter 8) point out to, different from the traditional governance approaches and the modernist narrative of science that envisions technology to inherently bring benefits and social progress (Felt, et al, 2007). Traditional approaches have always failed to encourage public participation in scientific endeavours. In occasions where the public is consulted, such engagement fails to recognise and integrate the lay views in science development policy making processes (Backstrand, 2003) and technological risks assessment exercises (Stirling, 2008). Thus, the wider and deeper questions of the public have still not been conceptualized and have persistently being neglected by elites who control processes of technological risks assessment.

The counter-narratives of science that were deployed by the publics (in both national contexts) to scrutinize the potential of emerging technologies, have defied not only scientific autonomy per se, but also the principal assumptions of classical public understanding of science (Bauer, et al, 2007). Again, these narratives transcend the linear expert technological risks assessment criteria which are heavily based on biosafety, to questioning the socioeconomic and political considerations that miss out in formal risk assessment processes.

My key argument here is that these public narratives may not always be plausible, but it shows the social, economic, cultural, and political factors that are often shrouded in traditional governance approaches. For example, particularly for the UK including other Western contexts (see Macnaghten, 2020; Macnaghten and Guivant, 2010; PABE, 2001), trust appears to be a salient public discourse on novel technologies, and the linear model has done little to address this issue in policy circles. Findings from this study invite a reflection on how public opinions and attitudes to emerging technologies are formed, configured and crystallised into a singular vocabulary, with questions of institutional trust and efficacy, meanings and purposes of technology, ethics and morality, in addition to questions of equity.

To do this, I recommend that policymakers and scientists involved in development and governance of science and innovations must turn away from the unsuccessful technical risks governance and communication strategies that dominates science risks assessment and communication programmes. Rather, scientists and policymakers must admit past regulatory failures, reflexively and inclusively

engage with the discourses of 'technoscientific failure' and make radical changes in the institutional culture that controversial technologies (such as GMOs and other emerging technologies) are embedded.

Furthermore, the political imaginary of public engagement must be reconceptualised, to redefine the epistemological role of the public in the production and governance of novel technologies. As shown above, in most contexts, public engagement exercises have not been formally integrated into the political culture (Macnaghten et al, 2019) and thus, giving scientists absolute supremacy. Such hegemony is not good for the future of science, as public engagement has been shown as a path to better policy decisions (Macnaghten et al, 2019). Going forward, policymakers and scientists must aim at responsible governance. An approach which encourage experts to include the public and anticipate the wider public and stakeholder concerns, and inspire experts to institutionalize formal mechanisms to elicit reflections on these concerns and represent them in science policy processes (see Stilgoe et al, 2013; Owen et al, 2013).

9.2   Reflection on limitations of the methodology

To end this discussion, it is crucial for me to reflect on the potential limitations of the methodology. Obviously, making a comparison of cases more than two decades apart, and with unequal and different set of samples in each case (group) pose challenges to internal validity. Particularly, my analysis of the UK publics' responses to emerging technology (GMOs) may not reflect the current opinion of the people, as their attitudes, perhaps, could change over time. Notwithstanding, since all prospective studies conducted in the 2000s revealed that the UK publics are not enthused over GM foods, and the UK government's ban on GM crops and foods remains, I argue that the findings that I have discussed may not be absolutely true, but are valid. Thus, making it reasonable to compare it with the responses of the Ghana group.

Again, for the Ghana group, because the sample was small and consists of only students, it gives rise to a question, in terms of the comprehensiveness and generality of the response. Therefore, I do not claim that the overall group effects and vocabulary of the Ghana group is a true reflection of the responses of the Ghanaian publics to emerging technology (GMOs). However, such findings enhance our understanding of the broad spectrum that structure people's responses to emerging technologies in Ghana.

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