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„Experts' framing of the risks of exposure to
electromagnetic fields in a 2014 controversy about
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Introduction

The question of whether the electromagnetic fields (EMF) emitted by mobile phone base stations is harmful to human health or not has been so far controversial in Thailand. Nowadays, significant attempt has been made by the Office of National Broadcasting and Telecommunication Commission (NBTC), a regulatory body of this industry, in order to educate the public that living close to the base stations is not conducive to the harmful health effects. However, potential health effects of EMF exposure have still been criticized not only among Thai citizens, but also experts who have particular interest on such an issue.

In 2006, according to the English news article from Bangkokpost (2016), a debate over the danger of EMF emitted by the mobile phones base stations was triggered in Thailand when the first public complaint reached the Office of National Broadcasting and Telecommunication Commission (NBTC), requesting for the removal of the three base stations installed near the town house. The controversy has been surrounding the case of locating the base stations in residential areas. People living close to the base stations claimed that several illnesses such as headache, memory loss, cardiac disease, and cancers were caused by having cell towers installed in their neighborhood. In the following years mounting cases of petitions occurred in many regions of Thailand against the installation of cell towers in public vicinity.

In Thailand the mobile phone base stations can be seen everywhere. Although the regulatory measures have been adopted in response to public concern, still, there are several public complaints about the danger of EMF released by these masts. According to the English news article from Bangkokpost (Wongsamuth, 2016) as well as my experience when I was in Thailand, “Radio waves from cell phone towers are not as harmful as you think” is the official government tagline which can be heard in 30-second radio spot produced by the National Broadcasting and Telecommunications Commission (NBTC). This tagline can also be seen in the leaflets and banners on public transportation bus, as well as on billboards in front of schools and government buildings (para.1).

NBTC also has a website as a part of the project to educate the public about the effects of exposing to EMF radiation, echoing the same message over and over (para. 3). Due to the Thai article published in Thammasat Institute of Area studies (2016), NBTC Secretary General, Mr. Thakorn Thantasit, claims that “there are many public complaints regarding the fears of adverse health effects from exposing to EMF. However, there is one complaint claiming that the installation of base station close to their houses is the cause of headache. After we went to check the area, it turns out that the antennae have not been installed. There is only the structure of the cell towers (para.2).

In response to public concern, NBTC, as an authoritative regulator of this industry, authorized King Mongkut's Institute of Technology Ladkrabang (KMITL), a research and educational institution in Thailand, to perform a field site study, examining the level of EMF released from cell towers. The result of the study was proclaimed in the press conference held in July, 2014. This official announcement made by KMITL's researchers on the panel was criticized by independent researchers who participated as audiences in this press conference for its lack of study on the relation between EMF exposure and adverse health consequences.

Given the disagreement among experts in this press conference, it intrigues my interest to examine how the danger of exposing to EMF released by the mobile phone base stations in Thailand is differently framed by involved experts in the press conference held in July, 2014. Therefore, the diversity of frames made by experts, and how it is related to the concept of expertise are regarded as the central aim of the master thesis. I consider the concept of 'regulatory science' as the backdrop of analysis owing to their expanded role of scientists as advisors (Jasanoff, 1990). This concept, as Jasanoff suggests in her webpage on regulatory science, demonstrates "how political institutions and cultures authorize, and thereby condition, the production, reception, and uptake of expert knowledge" (Jasanoff, n.d., para. 1). Moreover, the controversy among experts about the danger of EMF also highlights the importance of using the concept of 'boundary work' (Gieryn, 1983) in examining how experts draw the boundary between reliable and unreliable knowledge claim in health risk issue.

The association between EMF exposure and adverse health consequences has been extensively discussed internationally and nationally. In the absence of scientific consensus on such matters, scientists with relevant expertise from different countries have suggested exposure's level reduction, precautionary approach and further research (Vijayalaxmi & Scarfi, 2014). Hence, it is interesting to take into account this phenomenon in the context of my country, Thailand, where Thai people share the similar concern as those of other countries. Particularly, as an STS student, this issue can be examined through the study of expertise in which the particular topic has received a great deal of contribution in STS field. The controversy among experts in Thailand over the danger of EMF is thereby an appropriate point to seek for the deeper understanding on such occasion, as well as to provide a solution through the lens of STS study.

The moment of controversy among experts in this conference is the point of departure for this master thesis in examining how the danger of EMF produced by mobile phone base stations is differently framed by involved experts, and how it is related to the concept of expertise as the central aim of the study. Framing theory will be utilized as the core theoretical framework for the analysis in order to gain expert's interpretation of the issue. This research consists of five interviews with those experts who participated in the press conference held in July, 2014. They are engineers, university professors, and doctor. Three experts are KMITL's researchers on the panel in the press conference.

Two of them are independent researchers partake as the audiences.

This master thesis is organized in seven chapters. The initial chapter begins with state of the art in which many relevant literatures regarding the EMF and health concerns have been discussed. Opening the first chapter with these studies aims to provide the readers with a background story on EMF concerns and how the controversy has been developed in the global context. Furthermore, the contribution from STS case studies are also raised so as to demonstrate significant perspective from STS in understanding the controversy. Regulatory measures from some other countries as well as Thailand are also introduced. Moving on to the next focus in this chapter, the aspects of expertise from the field of STS are presented with specific emphasis on expertise in controversy and role of experts performing regulatory science.

The second chapter is research question. The main research question - How is the danger of exposing to EMF released by the mobile phone base stations in Thailand differently framed by involved experts in the press conference held in July, 2014 - is elaborated by providing the overall background story and the aim of this master thesis. The main question is followed by three sub-questions. Theories and sensitizing concepts is the third chapter which focuses on the framing theory and boundary work. The concept of framing is considered as the core theoretical framework for this thesis as it seeks the different interpretation among experts. The fourth chapter is case study background demonstrating the timeline of controversy over base stations and health concerns in Thailand, the regulatory measures and standards, as well as the detail of press conference in 2014. Methods and materials is allocated in the fifth chapter. Qualitative interviewing is the single method used in this thesis in order to collect the data for further analysis. The interview was conducted with five experts involved in the controversy. After receiving the data, the combination of grounded theory and framing theory is regarded as the analytical process. The result of analysis process is also elaborated from the use of coding, the combination of framing theory, and how it yields the result. The sixth chapter is the result of this thesis. This chapter comprises of identifying framing function and analysis, expertise and regulatory science, and boundary work. Within this chapter, the major findings from this thesis has been elaborated. There are five tables as the product from conducting coding step in the analyzing process. The last chapter is conclusion which I conclude the vital observation of this master thesis so as the readers could make sense of how STS contribute to the study of expertise.

1 State of the Art

1.1 Electromagnetic field and Health Risk

Health effects of exposure to Electromagnetic Fields (EMF) have been intensely debated in many countries. Wifi access point, routers and clients, cordless and mobile phones including their base stations, Bluetooth devices, ELF magnetic fields from net currents, ELF electric fields from electric lamps and wiring close to the bed and office desk are the source of EMF radiation (Belyaev et al., 2016). Since the radars were introduced during the second world war, there was a growing public concern over the adverse health effects of EMF (Repacholi, 2010); “The level of concern has oscillated over time depending on the technology of the day: from the high frequency radiofrequency (RF) fields emitted by radars and radio and TV broadcasting to microwave ovens and then to the extremely low frequency (ELF) (mainly 50 and 60 Hz) electric and magnetic fields emitted by the generation, distribution and use of electricity, and more recently to the fields emitted by wireless communications systems” (Repacholi, 2010, p. 1). In 1960, biological effects of EMF exposures was studied in the Soviet Union, which made people then become aware of their safety when exposing to this radiation (Gye & Park, 2012). In response to public fears about consequences to health from the EMFs emitted by these technologies, considerable amount of scientific researches and studies on the biological effects of EMF have been carried out. However, it was still controversial whether EMF could cause illness in human (Repacholi, 2010); “The fact that science is not able to give unconditional assurances about safety from EMF emissions has led to many individuals calling for the use of precautionary approaches to keep emissions as low as can be achieved” (Repacholi, 2010, p. 1).

Global Institutions & Health Guideline

In response to public and governmental concern, International Radiation Protection Agency (IRPA) set up working parties in order to examine possible health problems related to EMF exposure (Mercer, 2016) leading to the establishment of “a new, independent scientific organisation —the International Committee for Non-Ionising Radiation Protection (ICNIRP) [...]” as a successor to the IRPA/INIRC in 1992 (ICNIRP, 1998, p. 494). In 1998, exposure guidelines were developed by ICNIRP in an effort to “[...] establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects. An adverse health effect causes detectable impairment of the health of the exposed individual or of his or her off- spring; a biological effect, on the other hand, may or may not result in an adverse health effect” (ICNIRP, 1998, p. 494).

According to the World Health Organization (WHO) (2006), a Model Act and a Model Regulation were developed in the International EMF Project providing the legal framework for other countries (Who, 2006); “An important aspect of this model legislation is that it uses international

standards that limits EMF exposure of people (ICNIRP exposure standards) and international standards that limit the emissions of EMF from devices (IEC and IEEE device emission standards) (Who, 2006, p. 5). WHO endorsed the exposure guidelines provided by ICNIRP; “For the purpose of this Act, the recommendations by the International Commission on Non-Ionizing Radiation protection (ICNIRP) with respect to Basic Restrictions and Reference Levels shall be adopted as the relevant EMF Exposure Limits” (Who, 2006, p. 10). The guidelines of ICNIRP became the standards adopted by several countries, including Thailand.

In May, 2011, the International Agency for Research on Cancer (IARC) as a part of WHO “[...] has classified radio frequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer, associated with wireless phone use” (IARC, 2011, p. 1). According to the most recent work by (Hardell, 2017), although IARC announced the evaluation of cancer risks of EMF which based on an evaluation of scientific evidence on the brain tumor risks, there seemed to be a lack of attempt made by other countries in reducing the level of EMF exposure. This was because they relied on the exposure guideline established in 1998 by ICNIRP which “based only on established short-term thermal (heating) effects from RF radiation neglecting non-thermal biological effects” (Hardell, 2017, p. 406).

Although the guideline proposed by ICNIRP was updated in 2009, it has been controversial as “still do not cover cancer and other long term or non-thermal health effects” (Hardell, 2017, p. 406). From the section of ‘basis for limiting exposure’ in the report of ICNIRP (1998), “only established effects were used as the basis for the proposed exposure restrictions. Induction of cancer from long-term EMF exposure was not considered to be established, and so these guidelines are based on short-term, immediate health effects such as stimulation of peripheral nerves and muscles, shocks and burns caused by touching conducting objects, and elevated tissue temperatures resulting from absorption of energy during exposure to EMF. In the case of potential long-term effects of exposure, such as an increased risk of cancer, ICNIRP concluded that available data are insufficient to provide a basis for setting exposure restrictions, although epidemiological research has provided suggestive, but unconvincing, evidence of an association between possible carcinogenic effects and exposure at levels of 50/60 Hz magnetic flux densities substantially lower than those recommended in these guidelines” (ICNIRP, 1998, p. 496)

As ICNIRP guideline did not consider non-thermal effects of exposing EMF radiation, several health illnesses were not considered such as “cancers, effects on neurotransmitters and neuroprotection, blood-brain-barrier, cognition, psychological addiction, sleep, behavioral problems and sperm quality” (Hardell, 2017, p. 406). Many scientists have become world-leading authorities in the field of EMF radiation and health effects such as Olle Johansson, Lennart Hardell, Martin Blank, David O. Carpenter. They participated in the BioInitiative2012 report, updated from 2007. This report (BioInitiative

Working Group 2012, 2012) was the work of 29 independent scientists and health experts from ten countries; “Sweden (6), USA (10), India (2), Greece (2), Canada (2), Denmark (1), Austria (2), Slovak Republic (1), Russia (1)” (p.2). The main goal of this report was to “[...] assess scientific evidence on health impacts from electromagnetic radiation below current public exposure limits and evaluate what changes in these limits are warranted now to reduce possible public health risks in the future. Not everything is known yet about this subject; but what is clear is that the existing public safety standards limiting these radiation levels in nearly every country of the world look to be thousands of times too lenient. Changes are needed.” (BioInitiative Working Group 2012, 2012, p. 4). Hence, it is interesting to observe the uncertainty of scientific knowledge which can be seen from the disagreement among experts to impose international standards.

According to this report, Hardell (2017) suggested that exposure guidelines of ICNIRP were too high “[...] gives a ‘green card’ to roll out the wireless digital technology thereby not considering non thermal health effects from RF radiation” (Hardell, 2017, p. 406). In the section of evidence for inadequacy of the standards, the report claimed that “The development of public exposure standards for RF is thus based on acute, but not chronic exposures, fails to take into account intermittent exposures, fails to consider special impacts of pulsed RF and ELF-modulated RF, and fails to take into account bioeffects from long-term, low-intensity exposures that may lead to adverse health impacts over time.” (BioInitiative Working Group 2012, 2012, p. 28).

Base Stations & Electromagnetic Frequency Exposure

In the website of Environmental Health Trust (EHT), a non-profit organization founded in 2007, this organization aims to provide basic research and education about environmental health hazards and promote constructive policies locally, nationally and internationally. According to the published article of EHT, many scientific studies have suggested a link between EMF exposure and adverse health effects namely “reproductive dysfunction, single- and double-stranded DNA breaks, creation of reactive oxygen species, immune dysfunction, stress protein synthesis in the brain, altered brain development, sleep and memory disturbances, and increased brain tumors” (EHT, n.d., para. 1). Regarding radio frequency emission from the cell towers and cell phones, “[...] cell towers emissions are at lower levels than cell phones. However, with cell tower exposure, the exposure is non-stop day and night and full body exposure” (EHT, n.d., para. 1). Many governments and local jurisdictions have shown their concern regarding the danger of exposing to EMF emitted by the cell towers in residential area, “[...] halted the placement of cell towers and cell antennae near schools and residences because of the higher density of radiation in the close vicinity to cell antennae” (EHT, n.d., para. 2). However, the body of research on humans is facing a problem of the inability to fully assess exposure due to a variety of variables related to exposure assessment (EHT, n.d.).

In the past decades, people became aware of the adverse health effects from many sources of EMF such as power lines, microwave ovens, computers, security devices, radar, and recently, mobile phones and their base stations (Kao, 2012). With an increasing use of mobile phones in many countries, base stations were constructed in residential areas. There were several cases of controversy over the danger of EMF emitted by base stations in many countries. According to Kao (2012), meteorological radar site was operated in Chigu, Taiwan. Due to disproportionate medical problems suspected by the public, they called for the dismantlement of this station, however, the Central Weather Bureau claimed that there was no scientific evidence regarding the relation between EMF and health effects (Kao, 2012).

In the website ‘wireless education’ (2017), there were two cases of petition in France over the removal of the cell towers regarding their locations that were close to home and school. In 2006, the initial ruling took place when three families who lived in Tassin-la-demi-Moon, in the Lyon suburbs, appealed to the court that the relay antenna was installed close to their houses (para.3). The court reviewed Bio Initiative reports and scientific reports before judging that the tower must be removed.

In 2010, 26 residents complained of the health risk posed by a cell tower which was placed just 80 meters from their home in the Pyrenees-Orientales region in France (wireless education, n.d., para. 2). A French Telecommunications Company therefore had to dismantle the cell tower. Although the risk of exposing to EMF remained hypothetical, French court relied on a precautionary principle stating that “the precautionary principle enacted by section 110-1 of the Environmental Code which states that

limitations in scientific and technical knowledge should not delay the adoption of effective and proportionate measures to prevent a risk of serious and irreversible damage”. (wireless education, n.d., para. 2). Since 2010, there was a public concern in India regarding the danger of EMF emitted by the cell towers (Mukherjee, 2016). Cancer cases among urban residents living close to the base stations have been reported by the Indian news media namely cancer cases in the Usha Kiran building located on Carmichael Road and public request for the removal of the cell towers on the top of Vijay Apartments (Mukherjee, 2016). The largest mobile tower company, Indus Towers, operated 119,881 towers with 270,006 tenancies, showing the ubiquitous existence of mobile towers in India, and locating the these masts near to public vicinity yields a benefit for the telecom operators (Mukherjee, 2017). Due to the most recent English article published in Indian newspaper ‘the Times of India’ (Mahapatra, 2017), a man, who claimed that he was afflicted with cancer from continuous and prolong exposure to radiation of the cell towers for 14 years, was successful on his individual’s petition alleging harmful radiation, persuading the supreme court to shut down the mobile phone tower. This resulted in the debate among activists “[...] feeling vindicated while the government argues there is no evidence to prove that the waves cause cancer (Mahapatra, 2017, para. 3). However, government and operators in India have denied the allegations and claimed that there was no scientific study showing the relation between mobile phone tower radiation and cancers or vanishing of sparrows, crows and bees (Mahapatra, 2017, para. 9).

Government & Regulatory Measures

In the absence of scientific consensus over the association between EMF exposure and negative health consequences, some expert reviews rely on the exposure guideline recommended by ICNIRP, simultaneously, there has been discussion about the application of precautionary principle as the part of continuing debate over possible unidentified health effects according to EMF exposure from mobile phones and base stations (Dolan & Rowley, 2009). According to the work by Vecchia (2007), “concerns for hypothesized, but unproven, long-term effects of chronic exposure to low-level EMF have created a demand for pre- cautionary measures beyond the standards for recognized, acute effects. Such measures [...] should be separate from exposure standards, and adopted with special care to avoid undermining the credibility of science-based guidelines, and of health authorities” (Vecchia, 2007, p. 260). Work by (Kheifets, Hester, & Banerjee, 2001) suggests the basic definition of precautionary principle as these following; “Where there are threats of serious or irreversible damage, uncertainty should not be a reason for postponing action to prevent that damage”, “Where there are threats of serious or irreversible damage, precautionary measures should be taken even if cause-and-effect relationships are not clearly established”, “Whenever an action or substance could cause irreparable/irreversible harm, even if that harm is not certain to occur, the action should be prevented and eliminated” (Kheifets et al., 2001, pp. 115–116).

In response to public concern over the adverse health effects of EMF exposure, political decision makers considered precautionary measures including health related measures such as “exposure minimization strategies or stricter exposure limits, process- related measures such as better risk communication and enhancing public participation in base station siting decisions, and research-related measures” (Wiedemann & Schütz, 2005, p. 402). Countries differently adopted an option, as Wiedemann & Schütz (2005) suggest, in order to deal with public exposure of EMF, for instance, “participatory site selection of base stations in the Netherlands, stricter exposure limits in Switzerland, and better risk communication in the United Kingdom (public access to databases revealing the sites and technical features of the base stations), as well as labelling of cellular phones (discussed also in Germany) and general exposure reduction measures” (Wiedemann & Schütz, 2005, p. 402).

According to the report on the implementation of the Council Recommendation on the limitation of exposure of the general public to electromagnetic field produced by European Commission (2008), this document offers details on legal measures, monitoring, communication and research activities in EU. Most member states have adopted the Council Recommendation and/or the ICNIRP guidelines, while “[...] a few Member States apply more stringent limits on a precautionary basis [...]” (European Commission, 2008, p. 3). A common framework of basic restrictions and reference levels proposed to the Member States are based on “[...] the guidelines of the International Council for Non-Ionizing Radiation Protection (ICNIRP), which are derived from acute effects of EMF exposure on

humans, considered by ICNIRP the only effects for which proven scientific evidence is available” (European Commission, 2008, p. 3). In 1999, the Council adopted Recommendation 1999/519/EC on the limitation of the exposure of the general public to EMF (0-300 GHz), serving as a basis for EU legislation on products and devices emitting EMF (European Commission, 2008).

This report (European Commission, 2008) provides reviews over the implementation of measures which is differently adopted by the Member States. As the protection of public health against the adverse health effects of EMF exposure is under the Member States’ responsibility, in the section of Executive Summary, this report (2008) concludes how EU countries differently adopt legal measures to cope with public fears; “Subsequently most Member States have transposed the limits set by the Council Recommendation into their legislation and have legally binding measures to control EMF exposure of the general public. Bulgaria is in the process of implementing the Recommendation and the Slovak Republic is amending the current legislation. Germany and the Netherlands have only implemented a limited number of measures foreseen in the Recommendation (in particular on ELF), but are designing new legislative measures to ensure a more complete implementation. Denmark has not implemented legally binding measures, but they follow the ICNIRP guidelines for the assessment of the exposure of the general public. In Ireland the ICNIRP guidelines have only been adopted in relation to the licensing conditions by the Communication Regulator. In Spain the autonomous communities may implement stricter measures than those in the national legislation. Belgium is the only country with regional differences in the legislative provisions for the protection of the public in relation to EMF” (European Commission, 2008, p. 3). Moreover, some modifications on the Recommendation are suggested by some Member States; “ more stringent restrictions and reference levels for extremely low frequencies (ELF, 0-300 Hz) given concerns on possible increased risk of childhood leukaemia (Finland, Sweden and the Netherlands), more strict restrictions and reference levels at fields of 10 kHz-300 GHz (Lithuania), long- term and non-thermal effects of EMF (Bulgaria), information on product safety (Poland) and the restrictions and reference levels for radio frequencies (RF) radiation (Sweden) (European Commission, 2008, p. 4).

Regulatory Measures in Thailand

According to the Thai article from NBTC website (2017), it suggests that “EMF released by the base stations in Thailand is considered as much lower than what has been offered by international safety standards. Due to the conclusion of WHO, this kind of radiation is not conducive to adverse health effects”(NBTC, 2017, para. 7). Furthermore, NBTC claims that according to credible scientific researches there is no relation between living near to the base stations and several illnesses namely vomit, headache, insomnia, memory loss (para.8). The claim that base stations should be installed at least 400 meters far from the public houses is not reliable as this rule has not been adopted by Thai government as well as other governments (para. 6). The regulatory measures in Thailand are these following; “Mobile operators must seek a license from the NBTC before installing a base station. Under the new law, they must provide evidence of attempts to enhance the understanding of residents near the station site, particularly in areas such as hospitals, schools and childcare centers. This is to build confidence in the towers’ safety and allay any possible public fears” (Wongsamuth, 2016, para. 10).

There are two documents, as NBTC article (2017) suggests, requested by NBTC before a license can be given to the mobile operators; (1) the evidence of attempts in performing public hearing which shows that the residents allow base stations to be installed in their living area. (2) the evidence of evaluating the level of EMF emitted by the base stations. This aims to ensure that EMF radiation released by these masts is lower than the given standards (para.9).

In response to the public concern about cancers caused by EMF from the base stations, NBTC (2017) refers to the study conducted by the International Agency for Research on Cancer (IARC) as a part of WHO claiming that EMF is classified as ‘possibly carcinogenic’ to human (Group 2B)(IARC, 2011), which means that EMF might be the cause of cancers. However, the study is based on mobile phone users (NBTC, 2017). In that sense it implies that EMF from base stations is not counted as possible carcinogenic. The study conducted by this organization merely confirms the relation between cancers and regular mobile phone users (NBTC, 2017, para. 11).

Relevant Academic Research in Thailand

In Thailand several studies have been performed to evaluate the danger of exposing to EMF radiation. Summeth Vongpanitlerd is one of the leading independent researchers in Thailand who actively engages in the field of electromagnetic field radiation (EMF) and adverse health consequences. He tries to raise public concern and re-establishment of preventive measures through many of his published articles. This expert also play important role in raising awareness among the public about the danger of exposing EMF. His contribution to this issue is not merely restricted to the danger of EMF when living close to the base stations, rather, his work also focuses on the other tools that emitted this kind of radiation such as Wifi routers or television.

With the popularity of mobile phones and internet, the considerable demands from consumers are as high as competitive business among telecommunication suppliers (Sumeth Vongpanitlerd, 2008). Having reviewed several studies and researches about the adverse health effects from EMF, he argues that the safety standard from ICNIRP is suspicious and that NBTC should reconsider current scientific evidences as well as striving for precautionary principle in order to reduce the potential risk from exposing to EMF radiation (Sumeth Vongpanitlerd, 2008). His works and the documents that he collects have been represented in his personal account on the open webpage. One of the interview respondent claims that he has a close relationship with this expert because he is the leader, in the other word, he is one of the prominent activist against the installation of base station in Thailand. I also plan to have the interview with him. Unfortunately, he already moved to live in the countryside which is difficult for me to reach him personally. Furthermore, he was older and his presence in the conference is less observable, therefore, I rely on the other sources of information that he provided in his personal account in the website. Those documents are very helpful in investigating the dynamic of the controversy about the danger of exposing to EMF in Thailand, as well as the argument in the other countries. There are some slides which has been previously used when he went to join the discussion with the regulatory body like NBTC. Moreover, there are also several document which he translated from the English version into Thai version so that the Thai people can easily get an access to the controversy. In that sense, we can observe his prominent contribution including translated version of some articles pointing at the stark warning on the hazard of EMF.

Manit Rijimethaphas is one of the most cited scientists in news and articles regarding his letter to NBTC about the danger of EMF signal. He wrote a letter to NBTC expressing his concern over the danger of ‘electrosmog’, which is the inevitable electromagnetic radiation emitted by the use of wireless technology and main electricity. He offers solutions to decrease the danger of exposing to EMF together with several case studies from other countries that have previously experienced the negative outcome of electrosmog (Rujimethaphas, 2014). This expert has been also cited by the interviewee, however, it is difficult to find the other works that he provides except the letter to NBTC. I planed to have the

interview with this expert, nevertheless, it is impossible to find his contact. It might be the case that he lived in the other countries as I found out that he is the professor in the university oversea.

Reviewed article by Sudsiri (2011) concerns the negative health effects of EMF emitted by the base stations. She points at the importance of precautionary principle which helps to prevent the potential risk of exposing to EMF. Most of the studies in Thailand have focused on the effects of exposing to EMF in human and the establishment of preventive measures and policy. The role of experts who partake in the process of decision making has never been studied, particularly, from STS perspective. Working on this project by using the lens of STS study is very interesting in the context of Thailand. In my country there is no department of Science and Technology Studies (STS).

STS Case Studies on the Controversy over EMF

With the prevalence of scientific/advisory discourse about mobile phone risk in the late 1990s,) (Stilgoe, 2005) discusses a ‘discourse of compliance’ referring to “[...] the discourse used compliance with advisory guidelines as the endpoint for discussions with the public” (p.55). Conceiving this style of scientific advice as a barrier to expert engagement with public and the broader context of uncertainties about the safety of mobile phones, he suggests that although the discourse of compliance represents only the best available science, it is still fragile (Stilgoe, 2005).

“Experts pronouncements of safety are more likely than ever scrutinized and questioned by media, non-governmental organizations, branches of government and concerned member of the public” (Stilgoe, 2007, p. 46). This statement illustrates that merely reliance on scientific advice is insufficient. His article proposes a focus on experts who are charged with advising the government and the public over the issue of mobile phone risk in the UK context. This particular case in UK is similar to the context of controversy over the danger of EMF in Thailand, where experts have been questioned and skeptical about the credibility of scientific advice. Moreover, he also points to the context of lost credibility leading to the importance of engagement with interested non-expert and the construction of public concern (Stilgoe, 2007). His work also examines the relationship between experts and public, contributing to an understanding of public engagement with science.

According to the work by Stilgoe (2016), the controversy over the health risks of mobile phones in the context of UK was at its peak around 1999-2000, in which the openness in the practice of expert advice was encouraged by policymakers. Nowadays, concerns about health risk of mobile phones, as Stilgoe (2016) suggests, have been fading from the public perception as they become aware of benefits

from using mobile phone technology which outweigh the minor uncertainties. However, “this framing neither explains the nuances in the controversy, nor provides useful insights for the future practice of scientific advice” (Stilgoe, 2016, p. 7). In that sense, he offers to read this case in terms of ‘the social control of uncertainty’. He suggests that there are multiple objects of concern in EMF health issue in which the uncertainties are unevenly distributed namely the language of health risks, the politics of planning and the imposition of infrastructure (Stilgoe, 2016).

Given the expert’s attempt to govern this issue as one of risk, Stilgoe (2016) suggests that this led to an expansion and loss of control of uncertainty. He refers to the work by Hermans (2014) considering the politics of mobile phones in Netherlands which can be seen from considerations of democracy, fairness, aesthetics and property prices. With the use of personal dosimeters among the worried citizens, Hermans (2014) claims that expert practice and scholarly analysis have been challenged, showing the privileges explanations; “the solution is to mind the gap between laypersons’ and experts’ views on the risks” (Hermans, 2014, p. 26). Therefore, in the controversial context about health problems caused by wireless communication technology, it is vital to focus on “[...] the way the issue has been dealt with by policymakers, scientists, citizens and other actors involved in siting controversies” (Hermans, 2014, p. 26). As in the case of controversies over mobile phone antennas in France (Borraz, 2011), it shows that the application of a risk framework by experts fosters uncertainty; “the more authorities and experts attempt to apply a risk approach to an issue, the more they encourage the production of uncertainty” (Borraz, 2011, p. 969).

“It is of course impossible to say definitively whether expert advice has been successful, not least because of disagreements on the purposes of expert advice and the multiple and conflicting interests with which it must necessarily engage” (Stilgoe, 2016, p. 7). Stilgoe (2016) gave an example of precautionary approach as it reframes the health risk issue as ‘ongoing experimentation’ and ‘widening the bounds of legitimate uncertainty’ (p. 7). This precautionary approach has been argued to amplify risk perception (Wiedemann & Schütz, 2005).

Given the trouble with interpreting the issue as one of risk in scholarly research or advisory practice, Stilgoe (2016) claims that “[...] it becomes static: scientific opinion and public opinion are both imagined as immutable” (p.7). To better understand the potential for mobility of both science and publics, he suggests that we should look at coproduced technical uncertainties and politics (Stilgoe, 2016). He provides an example of the Independent Expert Group on Mobile Phones (IEGMP) formed in 1999 by the UK government “[...] with a remit not just to review the science but also to consider present concerns about the possible health effects from the use of mobile phones, base stations and transmitters (p. 5). Stilgoe (2016) refers to the vital role of this organization as it “reframed science in terms of experimentation as well as evidence and, in demanding the construction of a reframed research program, invited non- experts into the experiment. Similarly, in its public engagement, the IEGMP did

not presume a static view of public opinion” (p.8). Instead of positioning expert advice as neutral and seeking closure which “offers no lessons for future expert practice” (Stilgoe, 2016, p. 1), he suggests that experts should open up the issue, made explicit those obscure uncertainties and encourage new research questions. As a result, this will lead to the remobilization of static constructions of both science and public concern (Stilgoe, 2016). Science-as-expertise has been challenged by the introduced ‘science-as-experiment’ which has significant implications for ‘advisory practices and structures (Stilgoe, 2016).

Public opinion has gained “new significance in expert advisory process” (Stilgoe, 2016, p. 8) through the dialogue in public engagement. According to the work by Soneryd (2007) on public dialogue practice around mobile phone risks in Sweden, the question about thermal effects as a stable and uncontested basis for regulation has been raised by the critical citizen groups in which regulatory actors “[...]need to response to this contestation in a way that does not destabilize their position. (Soneryd, 2007, p. 308). According to the analysis by the Swedish Radiation Protection Authority (SSI) as Swedish institution that is responsible for making the decision on acceptable levels of radiation, the analysis of this institution suggests that “this is done by defining non-thermal effects as “not yet knowns” in need of further research, admitting uncertainties that allow them to maintain a degree of control. It can thereby be treated as a topic for controlled research and qualified reassurance, rather than an admission of ignorance [...] responded to issues raised in the Transparency Forum as concerns that had already been met by existing regulations” (Soneryd, 2007, pp. 308–309).

According to this study, Stilgoe (2016) suggests that the articulation of public concern has been underscored rather than fixed public opinion. In that sense, “[...] articulations can change, and can be a way of navigating around things that may be “unsayable” in certain circumstances (Stilgoe, 2016, p. 8). This kind of response to public concern, as Soneryd (2007) offers, allows the decision makers “ to maintain their existing policies and regulations, while claiming to be responsive.” (Soneryd, 2007, p. 309). This SSI’s initiative on the dialogue with citizen groups has been regarded as a starting point for changes “toward a more open and responsive organization” (Soneryd, 2007, p. 310).

1.2 Expertise in Contemporary Society

When we talk about a standard view of expertise, its definition is revolving around “[...] specialist craft or knowledge a person is said to possess [...]. These characteristics of being a specialist apply to several roles in modern society, especially the professional and the scientist.” (Grundmann, 2017, p. 26). The study of expertise in modern society, as Grundmann (2017) suggests, is surrounding the question of “what expertise is and what experts do, what role they play in society and what role they should play [...] if experts should have a privileged position in democracies” (p.25).

However, the basic understanding about the role of expert in different societal contexts is taken for granted, thus, Grundmann (2017) offers that expertise should be contextualized in modern society and the sociological literature. He, therefore, offers five different theoretical frameworks for the analysis of expertise in contemporary society; (1) laboratory study, (2) expertise and counter expertise: the politics of knowledge, (3) regulatory science, (4) lay expertise, and (5) honest brokers (Grundmann, 2017). This master thesis will rely on ‘regulatory science’ as a backdrop in conceptualizing expertise in the case study. However, in this section I would elaborate on the five perspectives of expertise proposed by Grundmann (2017) as well as discuss the broader concept of expertise.

1.2.1 Laboratory Studies

In laboratory studies, Latour (1993), Collins (1985), (H. M. Collins, 2007; H. M. Collins & Evans, 2002) have argued for the power of scientific expertise in the laboratory setting. Practical participation on the laboratory bench has been regarded as core-set of competencies in which scientists obtain the significant tacit knowledge and claim their competent statements (Grundmann, 2017).

According to H. M. Collins & Evans (2002), they suggest that scientific expertise should be given a special place in society and its decision-making procedures (Grundmann, 2017); “One of the most important contributions of the sociology of scientific knowledge (SSK) has been to make it much harder to make the claim: “Trust scientists because they have special access to the truth”. Our question is: “If it is no longer clear that scientists and technologists have special access to the truth, why should their advice be specially values?”. This, we think, is the pressing intellectual problem of the age” (H. M. Collins & Evans, 2002, p. 236).

Moreover, the scope of non-scientists’ participation in decision-making has been questioned (Grundmann, 2017); “How far should participation in technical decision-making extend? Science studies have shown that there is ‘more to scientific and technical expertise than is encompassed in the work of formally accredited scientists and technologists, but it has not told us how much more”(H. M. Collins & Evans, 2002, p. 237). On the other hand, work by Latour (1993) does not deal with the role of expert in society, “but on the role of science and scientists, on the role of laboratories as sources of

political power, and on the similarity between science and politics” (Grundmann, 2017, p. 34). Laboratory studies, as argued by Grundmann (2017), focus on the role of scientists and their practice as well as their involvement in a wider net of relations. In that sense, the weak point for this approach in studying expertise has been political and institutional analysis (Grundmann, 2017).

1.2.2 Expertise and Counter-expertise: Politics of Knowledge

This perspective of expertise focuses on the question of political decision-making in modern democracies where expert knowledge is considered as vitally important (Grundmann, 2017). As suggested by Collingridge & Reeve (1986), two scenarios (under- critical model and over-critical model) are proposed illustrating a link between specialist knowledge and political decision-making (Grundmann, 2017). Grundmann (2017) argues that work by Collingridge & Reeve (1986) “contrast several myths and realities of science and decision-making, for example, that science yields true and reliable knowledge (which they think is a myth), whereas in reality politicians use scientific information to justify their decisions. This leads them to abandon the idea that expertise is something that can be derived from the model of scientific research” (Grundmann, 2017, p. 35).

“The first of these myths holds that the first step in making any decision is to reduce the uncertainties [...] by gathering in as much relevant information as possible [...] the uncertainties will disappear altogether when this is done, leaving a particular decision to be made” (Collingridge & Reeve, 1986, p. 2). “The myth of the power of science holds that whatever information is needed to reduce uncertainty in making a particular policy choice, science can meet the challenge, that the direction of research in science can be quickly and easily changed to provide the information required by policymakers without introducing intolerable delays in the policy process” (Collingridge & Reeve, 1986, p. 2). In that sense, as Grundmann (2017) offers, the two myths lead them to “abandon the idea that expertise is something that can be derived from the model of scientific research” (p.35). However, their work does not cover the dynamics of the politics of knowledge, and their understanding of expertise is restricted to scientific expertise (Grundmann, 2017).

1.2.3 Regulatory Science

The term ‘regulatory science’ takes into account the issue of expertise in performing the role of advisory committee. This approach, as Grundmann (2017) suggests, has been originated from the study of advisory committees by Salter et al. (1988) and later became prominent by Jasanoff (1990). Work by Salter, Liora, Levy, & Leiss (1988) offers the notion ‘mandated science’ so as “[...]to draw attention to this type of science that is not the outcome of an autonomous research process [...] but commissioned by public agencies keen to get specific and practical advice on regulatory policy issues” (Grundmann, 2017, p. 36). The purpose of mandated science is to make a judgement about multiple

sources of evidence, not to produce new scientific findings (Grundmann, 2017). Regarding expanded role of expert as advisor, Jasanoff (1990) asserts that “experts themselves seem at times painfully aware that what they are doing is not ‘science’ in any ordinary sense, but a hybrid activity that combines elements of scientific evidence and reasoning with large doses of social and political judgement” (Jasanoff, 1990, p. 229). This statement is regarded as capturing the most important aspect of expertise (Grundmann, 2017). Furthermore, lay public participation is restricted “[...] committee recommendations, however much weight they carry, are seldom accompanied by detailed explanations or consideration of alternatives” (Jasanoff, 1990, p. 229). Accordingly, regarding these findings Jasanoff (1990) suggests that we should take legitimacy of science-based decisions into careful consideration.

1.2.4 Lay Expertise

When considering the role of ‘ordinary’ citizens in the domain of public decision making, expertise is thus not limited to scientists working in the laboratory (Jasanoff, 2003). According to Wynne (1992), he offered an interesting insight on the role of lay people when they become experts. In the case of sheep farmers in Cumbria, Wynne (1992) explicated on the interaction between lay public and experts. Farmers experienced expert’s mistake over the predictions of contaminations while their informal expertise was ignored (Wynne, 1992). He called for an inclusion of the farmers in decision-making process and questions the expertise of scientists whose work was in the laboratory (Grundmann, 2017). Similar argument has been taken by Callon (1999) regarding how government scientists could have an effect on citizens (Grundmann, 2017). Callon's (1999) argument is about the lay experts concerns; “What they fear above all is that someone else may decide for them what is good for them, and that such decisions would be taken without the slightest knowledge of their needs or wishes” (Callon, 1999, p. 88).

1.2.5 Honest Brokers

Honest broker, according to Grundmann (2017), is one of expert role in typology identifying roles of scientists differently engaged in a decision-making process. Pure scientists, science arbiter, issue advocate, and honest broker are different role of experts developed by Pielke Jr.(2007). According to his work on the role of scientist as expert in the policy advisory process, the characteristic of experts in his typology suggest that pure scientists were not interested in the decision-making process, only wanted to share information based on facts, while “the science arbiter serves as a resource for the decision-maker [...] but does not tell the decision-makers what he or she ought to prefer” (Pielke Jr., 2007, p. 2). “On the contrary, the issue advocate tries to convince the decision-makers of one best course of action. Finally, the honest broker leaves it to the decision-makers to reduce the options and to make a choice (Grundmann, 2017, p. 41). However, Grundmann (2017) argues that the notion of honest

broker could be perceived as misleading as the other roles might be indicated as not honest. The major problem with the term 'honest broker' is "[...] the suggestion that experts as experts could somehow be independent from the decision process which they have been asked to join." (Grundmann, 2017, p. 42).

Nowadays, expertise has been perceived in a variety of profession namely science advisory bodies and consultants, decision-makers, legal counsellors, or medical doctors (Grundmann, 2017). However, using scientific expertise as yardstick or model for the quality or desirability of specific forms of expertise "[...] tends to obscure vitally important aspects of expertise" (Grundmann, 2017, p. 27). In that sense, expertise should not be regarded as a qualification merely for scientists.

Experts are not only recognized by their embodiment of skills and experience, but also their performance, particularly, when they are requested to share their knowledge as the advice for others (Grundmann, 2017). Past achievement, reliability and credibility were considered as significant aspects for experts performing a role as consultants (Grundmann, 2017) "Expertise thus defined contrasts not only with the notion that people possess something (knowledge or skill), it also contrasts with the notion that expertise is primarily linked to scientific activity" (Grundmann, 2017, p. 28).

In Hilgartner's (2000) book 'Science on Stage: Expert Advice as Public Drama' performance of expertise is another vital aspect that concerns expertise in public situation. This is an important line of Science and Technology Studies (STS) on expertise. He claims that scientific advice plays significant role in the politics of contemporary societies, particularly, when government needs expert advice as a resource in the formulation and justification of policies (Hilgartner, 2000). However, "the authority of scientific advice is often problematic. Science advisors frequently encounter challenges to their objectivity and expertise, and struggles over the credibility of scientific expert advice play a pivotal role in many policy arenas" (Hilgartner, 2000, p. 146). Scientific advice is thus analyzed as a form of performance in order to investigate how authoritative advice is brought to the public stage by advisory bodies (Hilgartner, 2000).

A dramaturgical perspective has been developed in an attempt to investigate the 'social machinery' that "advisory bodies use to construct and maintain their credibility" (Hilgartner, 2000, p. 146). This 'social machinery' which is utilized to produce, present, and defend science advice has never been investigated, in which he compares it to an unexamined 'blackbox'. (Hilgartner, 2000). This book therefore treats expert's advice as performance and provides theoretical framework to investigate the black box of advising. The theatrical metaphor has been used to analyze science advice as a form of drama, trying to examine how the advice has been produced, performed, and subjected to critique (Hilgartner, 2000).

1.3 Expert and Scientific Controversy

Although the dependence on expertise has become pervasive in our contemporary society, there is a growing suspicion about “[...] scientists, engineers, politicians, and business corporations who use science in order to push an agenda, or to promote or undermine a technology [...]” (Grundmann, 2017, p. 30). In the past decades, an intensive discussion among scientists, political actors and lay public has been surrounding the issue of public health implications of exposure to electromagnetic fields (EMF) from telecommunications and electric power technologies. Jasanoff (2012) suggested that controversy studies had been established in the academic field of Science and Technology studies (STS) long before 1987, prominently the case of nuclear power plant on Cayuga lake (Nelkin, 1971). Work by Martin & Richards (1995) argued that experts become involved in scientific and public controversies as consultants or providers of expertise. Furthermore, experts also played a role as active participants in the debate (Martin & Richards, 1995). They suggested that ‘neutral, disinterested, and objective expert’ was the old ideal eroded by the limitation of experts and expert knowledge in resolving the controversy (Martin & Richards, 1995).

The increasing involvement of expert in controversial issues became obvious over time, playing ambivalent role as both indispensable and suspect (Nelkin, 1975). In the modern society, expertise has been placed in a paradox. We are suspicious about experts, simultaneously, we are prone to rely on their expertise (Nelkin, 1975). According to Nelkin (1975), *“Scientists play an ambivalent role in controversial policy areas. They are both indispensable and suspect. Their technical knowledge is widely regarded as a source of power”* (Nelkin, 1975, p. 36). Regarding the public concern for implications of technological advances, scientists were requested to provide scientific advice based on their technical expertise (Nelkin, 1971). In this work, she focused on the role of expert when engaging in political activities; *“Involvement of scientists in political activity has long been a sensitive and divisive issue within the scientific community, and scientists have traditionally approached political issues with reluctance”* (Nelkin, 1971, p. 245). She explored the role of scientists in public- decision making in the controversy over the siting of a nuclear power plant on Cayuga Lake in upstate New York. This case is considered as relevant to the case of controversy over EMF and base stations in Thailand as it reflects *“the absence of conclusive data and the lack of an accepted theoretical framework”* (Nelkin, 1971, p. 253), which was similar to the absence of scientific consensus over the relation between health risk and EMF exposure. Although my thesis did not focus on the political role of experts in the controversy, this case study of Cayuga lake opens up interesting perspective of controversy regarding the conflicts between the ideals of scientific objectivity and those of public responsibility (Nelkin, 1971).

Experts were previously considered as educating the public and which was then resulting in preventing the eruption of the controversies' (Limoges, 1993). However, regarding the analysis of public controversies, Limoges (1993) suggested that "[...] the involvement of scientists in public disputes has promoted the political polarization of controversies, that expert knowledge has been almost routinely deconstructed in the course of litigation, and that expert's interventions have tended to be seen as ritualistic or manipulative schemes, thus losing much of their credibility" (p. 417).

Although experts have been questioned about their credibility in giving scientific advice, scientific expertise is much needed in resolving the issue of technoscience (Limoges, 1993). In that sense, scientific expertise is required in making the decision. "In the context of a controversy, any group which attempts to present its case and to participate in the critical assessment of alternative viewpoints without appealing to any scientific expertise puts itself in a very vulnerable position" (Limoges, 1993, p. 417). Regarding the role of expert in controversial context, the confidence in the expert power has now disappeared due to their involvement in public disputes (Limoges, 1993; Nelkin, 1975). "There was a time when the mobilization of experts was a taken-for-granted, unproblematic aspect of decision-making processes. Experts would 'educate the public' and, in so doing, prevent the eruption of controversies. It is upon such a basis that technology assessment, qua expert knowledge, was first established. Confidence in the power of expertise has now vanished" (Limoges, 1993, p. 417).

Regarding the public understanding of science and the role of experts, Limoges (1993) suggests that "unidirectional communication-such as the one preached in the 'fill the knowledge-gap' approach- or even bilateral communication- the 'listen to your audience to communicate more effectively' approach-would prove inefficient here" (p. 421). Furthermore, "[...] experts are not always on the same 'side', and they are not confronted with what used to be called 'audiences' [...] Participating groups are fully fledged *actors* in the controversies space, as much as the originator of the proposal that has triggered the controversy, or the institutional decision makers" (p.421). In that sense, this point shows that "all the actors involved in the controversies contribute to the dynamic unfolding of their content" (p.421). Limoges (1993) offers to apply 'the principle of symmetry' in an effort to highlight "the worlds of relevance represented in and constitutive of controversy" (p.421). Limoges (1993) suggested that controversies could not be closed by the acceptance of expert's advice as the end of the discussion because "in most — probably all — controversies, expertise is plural and contradictory, and mainly, because what is at issue during a controversy is the negotiation of the associations which should be established between the various worlds of relevance mobilized by different participants" (p.421). When experts provide data and information, "these elements have to be assessed and eventually used by other actors to have any effectiveness. This is why expertise truly is a collective learning process" (p.422).

Expertise does not come from the property of individual expert, but it is ‘ongoing learning process’ which is a result of the interactions between participants in the controversy (Limoges, 1993). Therefore, controversy can be investigated by considering “the diversity of worlds of relevance involved in the dynamics of any public controversy” (Limoges, 1993, p. 417). In other words, it is significant to consider “the strength of the networks with which experts are associated, that is from the articulation emerging from the controversy, which eventually will provide a basis for decision making” (p.424). Therefore, in order to understand expertise in the controversy, it is vital to take into account how each world of relevance, in other words, all the actors involved in the controversy have represented themselves in the controversy.

1.4 Regulatory Science

In the modern society scientists have played a vital role in the making of public policy. Knowledge produced by science and scientists has been conceived among the public as the much-needed advice in response to their concerns (Jasanoff, 1990).

According to Salter et al. (1988), “Public confidence in medicines, clear air and water, safe and quiet working conditions and reliability of some products rests in the belief that scientists have been consulted about their safety”(p.1). Scientific advisory committees are commonly perceived as performing an indispensable role, providing scientific and technical advice to policymakers (Jasanoff, 1990) Nevertheless, the important question has been raised by Jasanoff (1990) about “why does a regulatory process so strongly committed to rational decision making and use of expert knowledge so frequently fail to produce consensus over the use of science?” (p.2).

Although the reliance on expert’s advice has become obvious in the contemporary society, it is significant to consider the difference between knowledge-making in policy environment and knowledge making in laboratories or other scientific work places (Jasanoff, 2011). This point makes explicit for the contribution of Science and Technology Studies (STS) in studying knowledge production and use in the context of policy making (Jasanoff, 2011). Given the focus on the role of scientific advisory committees in policy-making process, knowledge applied to solve policy issue is called ‘mandated science’ in the work of Salter et al. (1988) while the term ‘regulatory science’ becomes highly visible in Jasanoff’s (1990) book ‘The Fifth Branch’ (Grundmann, 2017).

Mandated Science

The notion of ‘mandated science’ has been utilized in an attempt to highlight the type of science that is not the outcome of research process, but commissioned by public agencies in order to obtain specific advice for regulatory policy issue (Grundmann, 2017). Work by Salter et al.(1988) suggests to consider scientific advice in terms of mandated science.

“The term ‘mandated science’ refers to the science that is used for the purposes of making public policy. Science, here, includes the studies commissioned by government officials and regulators to aid in their decision making. This scientific work is designed and carried out solely for the purpose of supporting particular regulatory decisions. It also includes scientific work originally produced in more conventional scientific settings. [...] it becomes ‘mandated’ when an individual study is evaluated in terms of the conclusions it can offer to policy makers about the merit of particular regulations” (Salter et al., 1988, p. 2).

Although there is a significant difference between scientific research or conventional science and knowledge used in solving policy issue or mandated science, mandated science could also include academic research if it serves for the making of public policy (Salter et al., 1988). Moreover, mandated science can be observed from the way that the design and scope of scientific work is influenced by goals of policy making (Salter et al., 1988). The major difference between conventional practice of academic science and mandated science is that “[...] the relationships between science, values, public policy, and economics are acknowledged and explicit within it” (Salter et al., 1988, p. 186). In that sense, the authors suggest that “mandated science must be understood as a separate sphere of scientific work [...] Increasingly, decision makers and their publics are placed in a quandary. On the one hand they are increasingly dependent on science and scientists [...] on the other hand it is increasingly apparent that science cannot provide the clear answers that government seek, at least not at time when regulatory decisions are required. Moreover, science often provides conflicting answers [...] (Salter et al., 1988, p. 4).

The concept of ‘mandated science’ is well aligned with the case study of controversy over the danger of EMF among experts in Thailand. Due to the prevalence of the base stations and public complaints, KMITL’s researchers were commissioned by NBTC to perform a study in order to answer the question of whether living near to the base stations has potential harmful health effects or not. According to the notion of mandated science, it is interesting to observe in this case on how the scientific knowledge produced by KMITL’s researchers has been rejected by independent experts for a lack of transparency. The field site study illustrates the notion ‘mandated science’ in the sense that scientific work is mandated owing to its audience, policy makers, not scientists (Salter et al., 1988). Although this master thesis relies on ‘regulatory science’ as a backdrop of the analysis on expertise, ‘mandated science’ will also be taken into consideration because it highlights the role of scientific advisory committees providing their advice based on intermingled relation between science and policy-making.

Regulatory Science

In Jasanoff’s (1990) book ‘the fifth branch’ she argues for the role of scientific advisory committees in the making of policy. The concept of ‘regulatory science’ has been proposed in order to cope with the centrality of experts’ role in the regulatory process (Jasanoff, 1990). Although it has been obvious for the importance of scientific advisory committees in contemporary society, Jasanoff (1990) urges to examine how knowledge has been made in policy environments. With regard to the field of science and technology studies (STS), knowledge created to serve policy is less studied than those produced in laboratories or other scientific workplaces (Jasanoff, 2011). Knowledge for policy needs is “sociologically distinct from other forms of knowledge. [...] is produced in institutional settings and

under criteria of validity that are different from those of “basic” or “research” science”(Jasanoff, 2011, p. 1). In that sense Jasanoff (1990, 1995) suggests that there are significant differences between knowledge produced for the policy making, particularly regulatory science, and other forms of knowledge.

According to Jasanoff (1995), regulatory science is conceptualized by using concepts derived from social studies of science. There are three major findings from the field of sociology of science that must be taken into a serious consideration in discussing about scientific advice (Jasanoff, 1990); “(1) Scientific facts are socially constructed (2) Scientific paradigms and social prestige are important for the problems facing advisory committees (3) Through boundary work scientists decide who belongs to relevant professional and policy communities, thus holding up an appearance of scientific authority even in the face of uncertainty” (Grundmann, 2017, p. 37).

The Characteristics of Regulatory Science

To answer the question of how science used for regulatory purposes (regulatory science) should be categorized “in the light of currently accepted accounts of the nature of scientific claims and of the sources of conflict, consensus, and authority in science” (Jasanoff, 1995, p. 281), it is significant to understand special properties of science which form the basis for public decisions (Jasanoff, 1995).

Scientific claims are socially constructed. They do not reflect what is out there in nature, rather, they are certified by those “who are considered competent to pass upon the truth and falsify of that kind of claim” (Jasanoff, 1990, p. 13). She points at how these claims that are relevant to technological risk are socially constructed and how the players in technical controversies deliver diverse constructions of scientific reality (Jasanoff, 1990). In that sense the production of scientific knowledge is influenced not merely by theoretical and methodological limitations, but also “[...] factors unrelated to the presumed cognitive concerns of science, such as the institutional and political interests of scientists and their organizations” (Jasanoff, 1995, p. 281). With regard to scientific disputes in policymaking, disciplinary training, institutional affiliation, professional status, and ideological differences among experts lead to a variety of data interpretation (Jasanoff, 1995). These findings are regarded as vital implications for science in the policy process as they trigger the question of what is ‘good science’ (Jasanoff, 1995). In traditional view of science “truths revealed by nature are available for skilled scientists to discover [...] through careful experimentation” (Jasanoff, 1995, p. 281). However, sociology of science argues that “the creation of scientific knowledge is much less objective and methodologically controlled” (Jasanoff, 1995, p. 281). Therefore, the truth did not emerge out of nature through the use of scientific methods by scientists, rather, it is because scientists agree through complex process of negotiation and compromise for observations and experiments (Jasanoff, 1995).

Jasanoff (1995) highlights the differences between the term 'regulatory science' and 'research science' that "research science, as practiced in university laboratories, tends to be conducted in environments of relative consensus, governed by established paradigms and relatively clear methodological and quality control standards. In regulatory science, by contrast, standards for assessing quality tend to be more fluid, controversial, and subject to political considerations. [...] bound by strict time limitations, which impede scientific consensus-building" (Jasanoff, 1995, p. 282).

Regarding the properties of regulatory science conceptualized through the lens of social studies of science, Jasanoff (1990) suggests that scientific advice is entangled in the scientific and political realm; "the notion that the scientific component of decision making can be separated from the political and entrusted to independent experts has effectively been dismantled by recent contributions to the political and social studies of science. With the accumulation of evidence that 'truth' in science is inseparable from power, the idea that scientists can speak truth to power in a value-free manner has emerged as a myth without correlates in reality" (Jasanoff, 1990, p. 17). Therefore, the conventional science has been challenged due to the character of regulatory science as contingent and socially constructed (Jasanoff, 1990). Experts doing regulatory science tend to deliver their advice based on elements of science, society, and politics (Jasanoff, 1990). Her position also resonates with the work by Collingridge & Reeve (1986). They suggested that "the role of scientific research and analysis is therefore not the heroic one of providing truths by which policy may be guided, but the ironic one of preventing policy being formulated around some technical conclusions. Research on one hypothesis ought to cancel out research on others, enabling policy to be made which is insensitive to all scientific conjectures" (Collingridge & Reeve, 1986, p. 32).

Regulatory science, as Jasanoff (1995) offers, "provides the basis for policy, routinely operates with different goals and priorities and under different institutional and temporal constraints from science done in academic settings and without implications for policy" (p.279). This concept is highly relevant to the case study in this master thesis. With regard to the role of experts from KMILT, they provide scientific advice which become extensively controversial among other experts who claim themselves as independent researchers. The diversity of frame on the danger of EMF produced by involving experts can be explicated by using the concept of 'regulatory science' as the backdrop in analyzing how the controversy emerges and sustains. According to Jasanoff (1995), negotiations between science and policy in making regulatory decision are underscored in an attempt to cope with controversy about technical issue in regulatory setting which lies in the grey zone between science and policy or facts and value; "facts are uncertain, theoretical paradigms are underdeveloped, study methods are inconsistent and contested, and outcomes are politically salient" (Jasanoff, 1995, p. 282), hence, it is common to find subjective biases in experts' reading of the data. In that sense, she claims that regulatory science is

helpful in the explanation of why controversies about science occur regularly and are pursued in the regulatory process (Jasanoff, 1990, 1995).

Conventional technocratic assumptions about the nature of scientific knowledge and the role of experts have been challenged by the contingent and socially constructed character of regulatory science (Jasanoff, 1990). She proposes that the role of advisory committee “[...] rarely restrict their deliberations to purely technical issues. In fact, the experts themselves seem at times painfully aware that what they are doing is not ‘science’ in any ordinary sense, but a hybrid activity that combines elements of scientific evidence and reasoning with large doses of social and political judgement” (Jasanoff, 1990, p. 229). In that sense, science advice produced by experts performing a role as advisors in regulatory setting should be consider as not a pure scientific knowledge in conventional assumption, rather, experts are influenced by other political and societal actors.

2 Research Question

2.1 Main research question

“How is the danger of exposing to electromagnetic field (EMF) emitted by the base stations in Thailand differently framed by involved experts in the press conference held in July, 2014?”

The focus of this master thesis is on the role of experts in the controversy over the adverse health consequences from EMF exposure. In 2006, according to the English news article from Bangkokpost (2016), a debate over the danger of EMF emitted by the mobile phones base stations was triggered in Thailand when the first public complaint reached the Office of National Broadcasting and Telecommunication Commission (NBTC), requesting for the removal of the three base stations installed near the town house. In response to public concern, NBTC, as an authoritative regulator of this industry, authorized King Mongkut’s Institute of Technology Ladkrabang (KMITL), a research and educational institution in Thailand, to perform a field site study, examining the level of EMF released from cell towers. The result of the study was proclaimed in the press conference held in July, 2014. This official announcement made by KMITL’s researchers on the panel was criticized by independent researchers who participated as audiences in this press conference for its lack of study on the relation between EMF exposure and adverse health consequences.

The moment of controversy among experts in this conference is the point of departure for this master thesis in examining how the danger of EMF produced by mobile phone base stations is differently framed by involved experts. Regarding a variety of backgrounds, professions and positions of experts who partake in the conference, they represent different opinions and advice on the issue. This intrigues my interest to investigate the diversity of frames made by experts regarding the association between an exposure to EMF generated by the base stations and adverse health consequences, and how it is related to the concept of expertise as the central aim of the study.

2.2 Sub-Questions

The first sub-question is *“how do the experts conceptualize their own authority in providing authoritative and scientific advice?”*. By asking this question, I aim to understand how the diversity of framing is produced by experts, and with that different frames, how they conceptualize their expertise as having authority to provide public with reliable scientific advice. This question is considered as relevant to the main question of framing when the diversity of frames made by experts can be useful to reflect on how they perceive their own authority.

In addition to the focus on how advice is given by experts, societal actors that are mentioned by experts should be highlighted in order to understand how these actors influenced the way that experts framed such issue and provided advice for public. The second sub-question was *'How are the experts related to other societal actors?'*. By asking this question, it shows how the important actors play vital role in the controversy. Furthermore, the way experts related themselves to these actors can be useful in understanding the dynamic of controversy.

According to the controversy among experts, independent researchers claimed that scientific study produced by KMILT researchers was unreliable because it did not concern relevant health issue as well as a lack good scientific method. In this case, I would like to examine *'How are boundaries between reliable and unreliable knowledge claim in health risk issue drawn by experts?'*. The notion 'boundary work' will be utilized in investigating how experts draw the line between reliable and unreliable knowledge claim regarding the danger of exposing to EMF and health concern.

3 Theories & Sensitizing Concepts

3.1 Framing Theory

The essence of framing theory, as Chong & Druckman (2007) suggested, is that an issue can be viewed from different perspectives, and also implies multiple values and considerations. Regarded as one of the buzz-words in mass communication research, ‘framing’ was pervasively used in media and communication studies in the early 1990s after an article ‘framing as a fractured paradigm’ by Entman (1993) was published (Vliegenthart & van Zoonen, 2011). In social science framing concept was introduced by Bateson (1955) arguing that “statements don't have intrinsic meanings, but only acquire those in a frame that is constituted by context and style” (Vliegenthart & van Zoonen, 2011, p. 103). Nonetheless, many disciplines have used the concept of framing as a paradigm aiming at understating communication and related behaviors (Hallahan, 1999). Given the common use of framing for investigating the diverse interpretation of an issue, the core idea is to find out “what kinds of underlying assumptions and arguments are connected to a particular issue” (Huttunen & Hildén, 2014, p. 5).

Framing of issue

Work by Hallahan (1999) offers seven models of framing; framing of situations, attributes, choices, actions, issues, responsibility, and news. By considering the framing of issue in my analysis of experts, I aim to understand how the pressing societal concern about EMF and health risk has been differently framed by those experts through their opposing opinions, and how their advice has been given regarding their framing of the issue.

According to Hallahan (1999), framing has been conceived for sociologists as a way to ‘examine alternative interpretation of social reality’ (p.217), and this approach can be referred to as ‘the framing of issues’. A dispute between two or more parties over the allocation of resources or the treatment or portrayal of group in society has been rendered as an issue (Hallahan, 1999). He suggested that “issues frequently result in extensive public discussion and frequently require resolution within a public policy forum, such as a legislature or the courts” (Hallahan, 1999, p. 217). Therefore, the public concern over the danger of EMF from the base stations can be addressed as an issue which requires a solution by appealing to the court. He also refers to the question of interpretation as the heart of most issue (Hallahan, 1999). In that sense, he claims that “disputants involve in an issue often vie to have their preferred interpretation predominate so that others will see the dispute from a perspective similar to their own” (Hallahan, 1999, p. 217).

According to the work by Hallahan (1999), public debates on issue have been analyzed by using framing as a tool. Furthermore, he also suggested that the framing of issue has been utilized in the area

of negotiation and bargaining as well as legal framework in communicating with jurors (Hallahan, 1999). Framing of issues can also be applied with several societal concerns such as the framing of controversies involving politics, gender right, race, property right, the threat of religious cults and the marginalization of various groups in post-modern society (Hallahan, 1999).

In this master thesis, framing theory will be utilized as one of the theoretical approach in response to the research question of “*How is the danger of exposing to electromagnetic field (EMF) emitted by the base stations in Thailand differently framed by involved experts in the press conference held in July, 2014?*”. According to Entman (1993) definition of frame that “To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way to promote a particular problem or definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described [...] frames, then, *define problems* — determine what a causal agent is doing with what costs and benefits, usually measured in terms of common cultural values; *diagnose cause* — identify the forces creating the problem; make *moral judgement* — evaluate causal agents and their effects; and *suggest remedies* — offer and justify treatments for the problem and predict their likely effects” (Entman, 1993, p. 55).

Using framing theory in studying the controversial context of geoengineering, Huttunen & Hildén (2014) explores “how researchers frame geoengineering and what implications these frames have for the science-policy interface and the politicization of science” (p.3). As a result, there are three identified frames; Risk-benefit, Governance, and Natural balance, which underscore the controversial nature of geoengineering (Huttunen & Hildén, 2014). They suggest that researchers have different views on the nature of these technologies, leading to a variety of recommendations on the future of geoengineering (Huttunen & Hildén, 2014). Their work does not merely contribute to how researchers frame geoengineering, but also the implications of these frames for science- policy interface and the politicization of science (Huttunen & Hildén, 2014). Therefore, inspired by Entman’s (1993) work and Huttunen & Hildén's (2014) work in framing the controversy in the case of geoengineering, my analysis will consider the involving experts who engaged in the controversy and focus on how they formulate their interpretations on the danger of EMF and health risk issue.

The importance of issue framing has been considered in this master thesis as the way to understand how expert differently frame an issue of the danger of EMF and adverse health consequences. As the heart of most issue is about how it is interpreted, I consider the four framing functions proposed by Entman (1993) in order to understand how the issue has been framed by involving experts through their formulation and interpretation of the issue.

3.2 Boundary Work

The concept of boundary proposed by Gieryn (1983) deals with the problem of demarcating science from non-science intellectual activities. However, this notion is not limited to the demarcation of science from non-science. It also contributes to the demarcation of different disciplines, specialities, and theories within science (Gieryn, 1983). According to Gieryn (1983), “Science is no single thing: its boundaries are drawn and redrawn in flexible, historically changing and sometimes ambiguous ways” (p.781). In that sense, the key observation of this theory is that the boundaries are always changing. The core elements of boundary can be identified in four aspects: expansion, monopolization, exclusion, and protection of autonomy (Gieryn, 1983).

Expansion of authority refers to the performing of boundary work when authority or expertise is expanded into domains claimed by other professions and occupations (Gieryn, 1983). This notion is considered in describing the way communities of scientists compete for ownership of their scientific terrain. Hence, it is considered as not relevant to my case study.

Monopolization and exclusion is the idea that monopolization of professional authority and resources has been achieved by excluding others claiming that they are ‘pseudo’, ‘deviant’, ‘amateur’; “boundary work excludes rivals from within by defining them as outsiders [...] (Gieryn, 1983, p. 792). In that sense, the boundaries are drawn by a group of scientists “to exclude another also claiming to be scientific” (Gieryn, 1983, p. 788). This notion is considered as relevant to the case of controversy among experts in Thailand.

Protection of autonomy refers to how science is protected by putting the blame on scapegoats from outside; “[...] boundary work exempts members from responsibility for consequences of their work by putting the blame on scapegoats from outside” (Gieryn, 1983, p. 792). This aspect of boundary work is relevant to the case of experts in this master thesis. Through the lens of protection of autonomy, the relevant societal actors might be examined in the sense that how KMITL’s researchers put the blame on other possible factors or actors in an attempt to protect their autonomy.

The concept of boundary work has been employed by the work of Mercer (2016) in the argument about EMF and global institutions like WHO attempting to establish the guidelines and standards in response to the public concern over the significant health concern of EMF exposure. In respect of the distinctive contribution from STS, these issues can be investigated through exploring their epistemic dimension (Mercer, 2016). This includes the describing patterns of global knowledge-making institutions, and “[...] the way they engage in “boundary work” to attempt to include or exclude the knowledge claims of neighboring institutions” (Mercer, 2016, p. 89). The concept of boundary work has been used in explicating the number of dichotomies that set the EMF Project apart from its

alternatives (Mercer, 2016). Moreover, the boundary working rhetoric has been adopted to distinguish health effects and biological effects; “[...] “mere” biological effects are partitioned out of the domain of scientifically-based standard setting (Mercer, 2016, p. 99).

In this master thesis boundary work can be employed as an analytical concept through the lens of the notion ‘monopolization and exclusion’ and ‘protection of autonomy’. This concept would be worth in examining how experts draw the line between reliable and unreliable knowledge claim regarding the danger of exposing to EMF and health concern, as well as how experts put the blame on ‘scapegoat’ in order to maintain their authority of science.

4 Case Study Background

In Thailand the mobile phone base stations can be seen everywhere. Although the regulatory measures have been adopted in response to public concern, still, there are several public complaints about the danger of EMF released by these masts. According to the English news article from Bangkokpost (Wongsamuth, 2016) as well as my experience when I was in Thailand, “Radio waves from cell phone towers are not as harmful as you think” is the official government tagline which can be heard in 30-second radio spot produced by the National Broadcasting and Telecommunications Commission (NBTC). This tagline can also be seen in the leaflets and banners on public transportation bus, as well as on billboards in front of schools and government buildings (para.1).

NBTC also has a website as a part of the project to educate the public about the effects of exposing to EMF radiation, echoing the same message over and over (para. 3). Due to the Thai article published in Thammasat Institute of Area studies (2016), NBTC Secretary General, Mr. Thakorn Thantasit, claims that “there are many public complaints regarding the fears of adverse health effects from exposing to EMF. However, there is one complaint claiming that the installation of base station close to their houses is the cause of headache. After we went to check the area, it turns out that the antennae have not been installed. There is only the structure of the cell towers (para.2).

Setting Standards

The initial instance of tower-related complaint filed to NBTC took place in 2006, when the complaint reached NBTC requesting for the removal of the three cell towers installed near the townhouse in Dust area (Wongsamuth, 2016). In 2007, two laws related to safety standards of cell phone towers were published in the Royal Gazette (para.2). However, more than a hundred of complaints filed annually to the NBTC following the announcement made by the World Health Organization’s International Agency for Research on Cancer (IARC) in 2011; “with a total of 652 complaints filed to the NBTC since 2010. The top three complaints were filed against True Group (272), Advanced Info Service Plc (AIS) (217) and Total Access Communication Plc (Dtac) (97)” (Wongsamuth, 2016, para. 2).

According to this announcement, radio frequency electromagnetic fields has been classified as “possibly carcinogenic to humans (Group 2B) which based on an increased risk for glioma, a malignant type of brain cancer, associated with wireless phone use” (IARC, 2011, p. 1). However, NBTC claims that “the evaluation puts EMF on the same level as coffee, pickles and engine exhaust” (Wongsamuth, 2016, para. 2).

Due to the Thai article from NBTC website (NBTC, 2017) regarding the regulatory measures of base station installation, two documents are requested by NBTC before a license can be given to the

mobile operators; (1) the evidence of attempts in performing public hearing which shows that the residents allow base stations to be installed in their living area. (2) the evidence of evaluating the level of EMF emitted by the base stations. This aims to ensure that EMF radiation released by these masts is lower than the given standards (para.9). Unlike some other countries where cell towers are prohibited from being installed within a certain range of populations in order to minimize the level of exposure, “Thailand’s safety measures only include exposure limits used by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).” (Wongsamuth, 2016, para. 2). Regarding the question of how far should the base stations be placed in a certain range of populations to minimize the exposure, NBTC suggests that the claim among worried citizens about the certain range of 400 meters of installed base stations is not reliable as this rule has not been adopted by Thai government as well as other governments (NBTC, 2017).

In Thailand there are more than 60,000 cell towers which can be seen everywhere in the public living areas across the country (Wongsamuth, 2016). Many tower-related disputes between communities and mobile operators have been recorded, and operators tend to quickly pay the fine and relocate the towers as the operators install base stations regardless of NBTC approval (Wongsamuth, 2016). Moreover, “although violation of the law carries a fine of up to 100,000 baht and/or up to five years in prison, the NBTC has imposed fines of less than 10,000 baht in the past.” (para3.). Due to the Foundation For Consumers (FFC), FFC secretary-general Saree Aongsomwang said “most of the complaints relate to not creating an understanding with communities before installing mobile towers.” (para.3).

Press Conference

In response to public concern as well as a rising number of public complaints against the installation of base stations in residential area, NBTC as regulatory body of this industry authorized King Mongkut’s Institute of Technology Ladkrabang (KMITL), a research and educational institution in Thailand, to perform a field site study, examining the level of EMF released from cell towers. The result of the study was proclaimed in the press conference held in July, 2014. This official announcement made by KMITL’s researchers on the panel was criticized by independent researchers who participated as audiences in this press conference for its lack of study on the relation between EMF exposure and adverse health consequences.

This press conference is the point of departure for this master thesis in examining how the danger of EMF produced by mobile phone base stations is differently framed by involved experts. Regarding a variety of backgrounds, professions and positions of experts who partake in the conference, they represent different opinions and advice on the issue. This intrigues my interest to investigate the diversity of frames made by experts regarding the association between an exposure to EMF generated

by the base stations and adverse health consequences, and how it is related to the concept of expertise as the central aim of the study.

5 Methods & Material

5.1 Qualitative Interviewing

Since the objective of this master thesis aims to explore how the experts differently frame the danger of EMF radiation emitted by the base stations, interviewing those experts who participated in the press conference in which the controversy of particular issue was discussed is considered as the most appropriate method of data collection.

The data is collected from conducting qualitative interview with five experts who participated in the press conference in July, 2014. In order to answer the research questions, I consider in-depth qualitative interview as a method to gain an insight into the experience of experts. Interviewing field work was performed in the duration of closing semester in July and August, 2017. An appointment with five experts was complete one month before the actual interview. Interview was conducted and transcribed in Thai language. Coding and relevant quotes were translated into English. The duration of interviews last from 40 to 90 minutes.

According to David Silverman's (2006) book 'Interpreting Qualitative Data', he suggests that interview should not be understood as a means to gain access to the 'facts' or events. "Interviews do not tell us directly about people's 'experience' but instead offer indirect 'representations' of those experiences" (Silverman, 2006, p. 117). With a variety of opinion from involved experts in the controversy over the danger of EMF in Thailand, this thesis considers in-depth interviewing as a core method in seeking 'deep' information and knowledge (Johnson & Rowlands, 2012)

Using in-depth interviewing as a method to gather the data from involved experts, I aim at observing individual's self, lived experience, values and decisions, occupational ideology, cultural knowledge, or perspective of experts (Johnson & Rowlands, 2012). The benefit of using in-depth interview in a controversial context is that it offers the exploration in greater depth; "[...] if one interested in questions of greater depth, where the knowledge sought is often taken for granted and not readily articulated by most members, where the research question involves highly conflicted emotions, and where the different individuals of groups involved in the same line of activity have complicated, multiple perspectives on some phenomenon, then in-depth interviewing is likely the best approach" (Johnson & Rowlands, 2012, p.101). Moreover, it is also depended on the research question. In this case I would like to explore how experts differently frame the danger of EMF which somehow prefers the answer in greater depth. "[...] in-depth interviewing is best suited to research questions of the descriptive or exploratory type (i.e., questions that focus on what and how rather than why social

processes are enacted in everyday life) (p.101). However, it is interesting to notice how ‘deep’ the information interviewer could possibly achieve by using in-depth interviewing. Due to the work by Johnson & Rowlands (2012), if interviewers seek to gain “the same deep level of knowledge and understanding as the members or participants” (p.101), in-depth interviewing can be used as a means to learn the meaning of informant’s actions (Johnson & Rowlands, 2012).

In the process of conducting the in-depth interviewing, it is significant that the researchers should begin with a small talk, explaining the purpose of the research and then asking simple planned questions or the ice-breaking questions but “not to move so quickly into the issues of the key interview questions as to jeopardize intimate self-disclosure (or trust)” (Johnson & Rowlands, 2012, p.104). In the actual interview, I begin with the small talk with the informants by introducing myself as well as providing them some of the introduction about the topic of interest. After that, I ask the interviewees for the brief introduction about their educational background, careers, position in career, and how they become involved in the discussion about the danger of EMF of the base stations. As it is the first experience of conducting in-depth interview, Johnson & Rowlands (2012) suggest that the interviewer should begin with “[...] an actual protocol of questions: usually two or three introductory icebreakers...; several transition questions which may again explain the purpose of the interviewing project, secure informant consent, or elicit permission from the respondent to use a tape recorder” (p.106). Regarding the issue of sampling in this master thesis, I employ the purposive or theoretical sampling methods “that aims to identify specific interviewees because of their perceived ability to answer specific questions” (Johnson & Rowlands, 2012, p.105). Therefore, these five experts are selected to be interviewees in this project because they participated in the press conference. In order to reflect on my experience for this in-depth interview, it is interesting to observe how the informants try to convince the researcher. In that sense, as a researcher, it is significant to be aware of not taking side in the process of interview. In the next I will elaborate on my reflection over each participant.

1st interviewee: Chakree Maleewan – Independent Researcher

Mr. Maleewan claims himself as an independent research in the press conference. He is a university professor at Thammasat University teaching in the faculty of engineering. He is the first respondent of this in-depth interview. The interview took place at the department of engineering at Thammasat University. Regarding his prominent role against the installation of base stations in public vicinity, he provides a very useful insight in terms of his personal experience as ‘affected person’ as well as reflecting from his engineering knowledge about EMF and health risks. However, it is important to notice that those technical terms used in engineering is not considered here as an impediment because these technical terms might be useful for those who have engineering background and need to further investigate this particular topic.

2nd interviewee: Supol Suksrimangmee - Independent Researcher

Mr. Suksrimangmee is the second respondent for the interviewing. The interview was conducted at the library of Thammasat University. His role in the press conference has been recognized by the media regarding the document and court cases that he brings to present in the discussion. It is interesting to observe that although he did not have engineering knowledge and background, his role can also be perceived as an activist who fight against the base stations in neighborhood by gathering the document by himself. Furthermore, his experience winning the court cases of base station installed on the rooftop of his apartment has been recognized by other people who are facing with the similar problems. He then become one of the prominent experts who actively engage in the discussion with the mobile companies and the regulatory body like NBTC. It is interesting to notice that he was aware that it is dangerous to a certain degree when trying to be an activist against the installation of base station. He refers to some of his colleague who were intimidated by the power of this industry, which he also concerns that it might also be dangerous for me as the researchers. However, he insists that he will continue distributing the leaflets in the public area because it is the good thing to do for other people.

3rd interviewee: Tatchai Pumpuang - KMILT researcher

Mr. Pumpuang is the third respondent for this interview. Before the actual interview, he asked for the scope of questions which will be used in the actual interview. The interview took place at the coffee shop in the shopping center. It is significant to notice that the place of interview is very important for both the researcher and respondent. In this case, the noise around the table has not been perceived as obstacle in talking with the informant because the level of noise is acceptable. Nevertheless, it can be difficult for the concentration of both researcher and respondent. This interview lasts only 30 minutes which is the shortest one in comparison to the other four interviews. This might be the case that the location of interview is not suitable for doing in-depth interviewing. This type of interview requires a high level of concentration when it comes to the core argument of the issue. However, I gain a very interesting perspective and insight from Mr. Pumpuang. He is one of the researchers in KMILT's team. It surprises me to some extent when he claims himself as the leader of KMILT's researcher team but he did not have particular interest about EMF of base stations and possible health risks. He based his argument on the international standards provided by ICNIRP and accepted that the danger of EMF might be possible.

4th interviewee: Thanet Patthanathadapong - KMILT researcher

Mr. Pattanathadapong is the fourth interviewee for this interview. The interview took place at the department of engineering at Ladkrabang University. He was one of the researchers in the team of KMILT. However, he did not go into the field site study with other experts. He accepts that the other

member in the team might be able to answer the questions about the danger of EMF in a more understandable way. His argument is based on the standard of ICNIRP which should be sufficient to ensure the public about their safety when exposing EMF radiation released by the mobile phone base stations. However, he perceives that EMF might cause negative health effects in human but it took a long before ensuring this to the public. As an engineer, he also provides some basic understanding about EMF in order for the researcher to understand about the technicality of this radiation.

5th interviewee: Piboon Isaraphan - Doctor in KMILT's team

The last respondent for this in-depth interview is Mr. Isaraphan. The interview took place at the coffee shop. However, it is interesting to observe the surrounding noise in comparison to the interview with Mr. Pumpuang. From my perception, when there is less people surrounded in the interview setting, it is better for both researchers and interviewee to concentrate on the conversation. This interview with Mr. Isaraphan lasts for almost one hour. He is one of the informant providing a very interesting perspective towards the dynamics of controversy. As a doctor who had worked closely with the several cases of public complaints, his argument is based on how his experience with the actual cases can be useful in understanding the problem. Moreover, at the beginning of the interview, it is interesting to notice that he feels regret to participate as one of the KMILT's researchers. He did not agree with the method used in the field site study. Furthermore, he had different opinion about the advice that should be given to the public. He claims that KMILT researchers should not claim to the public that it is safe to live near to the base stations as in the world of petitioners they would not accept that it was safe, rather, the advice should be given that living near to the base station is risk but it was a lower risk. Moreover, he also claimed that NBTC should pose a strict regulation to those mobile companies. Due to his experience in talking with the public regarding their complaints for the removal of the base stations, he found out that most of the problems are from the side of the companies, particularly, those company did not comply to the regulation. In several cases, the mobile companies skipped the process of public hearing, or they made up the document of public hearing.

After pausing the recorder, the conversation was more relaxing. He show some pictures when he went to the field site talking with the public who complaint about the danger of base stations. There was one picture that he showed which strikes my attention. In the picture it was a small box which looked similar to the air condition. However, it was a new kind of base stations which came in a new form. This box made the public furious about the hidden agenda of the mobile company. Although it was smaller in comparison to the common cell towers, the public felt that these companies tried to hide the danger of EMF in this small box.

5.2 Framing & Grounded Theory

Prevalent used across disciplines and professions, grounded theory is regarded as a useful method for analyzing qualitative data, together with the popularity of interview utilized as a mean of data collection (Charmaz & Belgrave, 2012). They refer to the term grounded theory as “systematic method for constructing a theoretical analysis from data, with explicit analytic strategies and implicit guidelines for data collection (p.347). Moreover, grounded theory is also regarded as an inductive, comparative, iterative, and interactive method in keeping the researchers to interact with their data and analysis (Charmaz & Belgrave, 2012). They suggest that with the power of grounded theory regarding its integration of data collection and abstract level of analysis, “in-depth qualitative interview fits grounded theory method particularly well” (p. 348). The benefit of using interview data for grounded theory is that it helps us “to address organizations, social worlds, discourses, communications, policy questions as well as individual experience” (p.350). Interview is thus performed in an effort to gain an insight into the experience of expert.

According to my objective in doing this project is to investigate different frames produced by experts, I employ the combination of framing and grounded theory as the primary mode in the analysis of interview. I deemed the significance of framing theory, utilized as a core theoretical framework in this master thesis, and combined with grounded theory in order analyze the interview data.

5.3 Analysis process

This master thesis considers in-depth qualitative interviewing as a mean to collect the data, then, proceeds with the combination of framing theory and grounded theory in analyzing the data. Interview was transcribed, then followed by line-by-line coding. Qualitative coding is the initial step in moving beyond the concrete statement of the data for further analytical interpretations (Charmaz, 2006); “coding means categorizing segments of data with a short name that simultaneously summarizes and accounts for each piece of data. Your codes show how you select, separate, and sort data to begin an analytic accounting of them” (p.43). Charmaz (2006) suggests that coding is the link between collecting data and developing the theory to explicate on the data; “through coding, you define what is happening in the data and begin to grapple with what is means” (p.46). There are two major phrases in the conducting the coding. The initial stage is “naming each word, line, or segment of the data” (p.46). The second step is selecting the focused codes by seeking “[...] the most significant or frequent initial codes to sort, synthesize, integrate, and organize large amounts of data” (p.46).

Therefore, the next move was to select focused codes in order to categorize data. Codes were then refined by comparing data to data, and data these codes. After focused codes were collected, I rely on Entmann’s four framing functions; (1)problem, (2)cause, (3)moral interpretation, and (4)solution.

“Frames, then, defines problems — determine what a causal agent is doing with what costs and benefits, usually measured in term of common cultural values; diagnose causes — identify the forces creating the problems; make moral judgements — evaluate causal agents and their effects; and suggest remedies — offer and justify treatments for the problems and predict their likely effects” (Entmann, 1993, p. 52).

Questions are asked along the four framing functions ; (1)what is the problem in relation to the danger of exposing to EMF emitted by base stations, (2)what is the cause of this problem, (3) Are there any moral interpretation given, and (4) What should be done about the problem. I answered these question by looking at those focused codes, and then fit them into the four framing functions. By doing this, I could make sense of how each expert frame the issue. The result of this step was presented in the following section ‘*7.1 identifying framing functions and analysis*’.

After focused codes were allocated in each framing function, I could begin writing process. However, by allocating the focused codes in those four functions of frame, I aim to provide a broader picture of how individual experts conceives the controversy from his own perspective. By answering the research questions, I focus on relevant focused codes, as well as taking into consideration the surrounding context from transcription as the core of analysis work.

6 Result

6.1 Identifying framing functions & Analysis

1st interviewee: Chakree Maleewan – Independent Researcher

Problem	Cause	Moral Judgement	Solution
<ul style="list-style-type: none"> • A lack of control in the installation of base stations led to their prevalence in residential areas. • Public were in danger due to the over-exposure of EMF 	<ul style="list-style-type: none"> • Ambiguity in the whole system • Hidden agenda: serving industrial benefit, not the public • Hidden information: NBTC & telecommunication company did not provide the detail of technical specification of the base stations to the public (therefore, he could not calculate EMF level emitted from base stations) • Expert lacked of specialised knowledge, producing unreliable scientific data. • KMITL's researchers had their study background in communicative engineering, which was considered as lacking in-depth knowledge about EMF and health risk. 	<ul style="list-style-type: none"> • Experts should contribute to public benefit, not industrial one as neglecting it would result in harmful health effects among Thai population. 	<ul style="list-style-type: none"> • Government should take a serious action in controlling the prevalence of base stations. • Experts should have in-depth knowledge about the relation between EMF and health risk. • Raising public concern over the adverse health effects from exposing to EMF released by the base stations.

Expert Background

Mr. Maleewan was a university professor in the faculty of engineering at Thammasat University. He graduated with a bachelor's and a master's degree in Microelectronics. Although his background was in Microelectronics, he was also interested in Electromagnetic and Opto-electronics, taking anatomy and physiology courses. In the press conference, he participated as an audience. According to the KMILT's study result, he was suspicious about the methods used in the field site study as well as the knowledge of those experts on the panel. Furthermore, he was also recognised by the media asking him for the interview after the conference. Mr. Maleewan claimed himself as an independent expert joining the conference because of his personal interest on the topic, not under the authority of Thammasat University.

How was the danger of exposing to EMF emitted by base stations framed by experts?

Mr. Maleewan claimed that his health was affected by exposing to EMF radiation of the base station. He lost his short term memory and his mother also had cancer after the installation of base station in his residential area. In that sense, the danger of EMF was framed in relation to his personal experience as 'affected person'. Furthermore, due to his in-depth knowledge about EMF according to his educational background as well as personal interest, he believed that there was an association between EMF exposure and adverse health consequences. The danger of EMF was therefore perceived by reflecting through his own experience and expertise.

"I saw the installation of the base station which was very close to my house. This base station was the end terminal, which was very powerful in sending the signal more than ten kilometers away. Radiation is something we cannot feel to touch, thus, we have to study more about it. If unfamiliar object was installed near to your house, we should study more about it. As I was an academician, I learnt and had much knowledge about EMF. Moreover, EMF was the topic of my personal interest since I was just a student. I could track the level of emitted EMF if there was a detail provided"

Although he related the danger of EMF from the base station to his personal experience as affected person, he suggested that EMF should not be assumed as the cause of every health problem. Rather, he concerned that there were other possible factors such as toxic or the declination of health due to a lack of sleep or getting older. However, he did not mention in particular for which kind of toxic.

"I lived near to the base station, and my health was also affected by EMF radiation. I lost my short term memory. Thus, there were two things to remind. Firstly, a lost of short term memory was because I am getting older, or I did not sleep enough. Secondly, it was because of the EMF radiation emitted by cell tower. As you can see, there were also other possible factors causing health problems. Hence, we

could not blame EMF as the cause of every health issues.”

He was aware that EMF had some certain health effects for those people who were weak. Particularly, from the case of his mother who had cancer after the installation of base station near to her residential area, he mentioned that his family always cooked the meal at home and his mother was not supposed to have cancer. In that sense, EMF was the only suspect when cutting out other possible harmful factors.

“I am also affected by the EMF, but there were also other possible factors causing health problems. However, when we cut out other factors, it was only EMF. The possible factors were toxic and declination of health. However, my mother had a cancer although we always cooked the meal by ourselves and rarely went to eat outside. How could this happen?”

“Although EMF is not that fearful, but for those people who were weak, it could cause health problems”

He also expressed his concern over the danger of EMF which could have an effect on the larger scale of Thai population.

“If people over exposed to the EMF, they were risk of getting paralyse. Do not forget that if people lived in uncomfortable environment, they were weak”

He referred to his in-depth knowledge about EMF in consideration of how EMF could affect human body.

“When you have in-depth knowledge about EMF, you would realise that it was because the physical electronics sending the radiation within electronics elements. This could also affect the human body, but in which scale or which level of EMF, it depended on how much it was released from the base station”

In this case, the danger of exposing to EMF emitted by base stations was framed through his personal experience as ‘affected person’ as well as through his expertise. As he mentioned that EMF should not be assumed as the cause of every health problems, he framed the danger of exposing to EMF in terms of ‘possible’ cause of illness, particularly for those who were weak.

How do the experts conceptualise their own authority in providing authoritative and credible scientific advice?

In the press conference, Mr. Maleewan asked some questions regarding the perturbation and selection rule theory which he claimed that it was the basic knowledge in order to understand quantum physics. As KMITL's researchers were not able to answer his question, he claimed that they would never know how EMF could effect human health. Furthermore, as KMITL's researchers had their expertise background in communicative engineering, coming from other areas of expertise was concerned as lacking in-depth knowledge in providing reliable scientific advice. In that sense, he implied that authoritative and credible scientific advice should derive from experts with in-depth knowledge about EMF.

"I asked them if they knew about perturbation and selection rule theory which was the basic knowledge in understanding electronic dope and quantum physics. These researchers did not have knowledge about this. If they did not know, how could they know that this kind of radiation could get to human body."

"These experts did not have in-depth knowledge about EMF because most of them had their background in communicative engineering, thus, they will never know how EMF reacted to organism"

His role as academician and his personal interest in EMF were mentioned when he talked about his ability in tracking the level of EMF emitted by base station from the given detail. The detail was technical information of the base station which should be provided by NBTC or mobile company. However, in this case, he said that it was not given.

"As I was an academician, I learnt and had much knowledge about EMF. Moreover, EMF was the topic of my personal interest since I was just a student. I could track from the detail of the base station in order to know the emitted level of EMF. However, in this case I could not track because there was no technical information released by NBTC or mobile company"

According to his personal interest in EMF and engineering background, he concerned that with his in-depth and specialised knowledge he was able to deliver reliable scientific advice which was based on scientific and engineering evidences.

"What is wrong cannot be made right. There were evidences either from science or engineering knowledge. It should be made clear. Ambiguity cannot be turned into the right thing"

He considered himself as contributing to public benefit, not the industry as a moral judgement. Experts should contribute to public benefit, not industrial one as neglecting it would result in harmful health effects among Thai population.

“My benefit was not about money, but it was how I could contribute to the society”

“As a university professor and one of the population, it is important to protect the society”

How are boundaries between reliable and unreliable knowledge claim in health risk issue drawn by experts?

According to the research conducted by KMITL’s researchers, they announced the result of study in the press conference that it was not dangerous as the level of EMF emitted by the base stations did not exceed the international standard proposed by ICNIRP. However, Mr. Maleewan claimed that the methods was not presented in the report. In the absence of methods used in scientific research, the result was unreliable. This report was thus vague regardless of sufficient information to ensure that the level of EMF emitted by the base stations was within the standard. Unreliable knowledge claim was thus perceived due to a lack of research method in KMITL’s report.

“In press conference, I asked KMILT’s researchers about the methods used in conducting the field site study because it was not shown in the report. It seemed like they did not use much of the instrument in conducting the field study. If

they claimed that they tested the level of EMF around Thailand, I would like to

know how they set up the device, and whether the device was correctly managed.

How are the experts related to other societal actors?

NBTC was an authoritative regulator of communication industry. It was responsible for controlling the installation of the base stations. However, he mentioned that NBTC involved in the hidden agenda with KMILT’s researchers and mobile company. Large amount of budget was allocated to this research, but the result of this study was very unreliable. In that sense, the hidden agenda among these actors were considered as the cause of the problem. It was an ambiguity in the whole system, serving industrial benefit.

“I wanted to sue them for how they used the budget on this study. It was such a useless spending money on this project. I wanted those KMILT’s researchers to explain about the budget. They could not even answer my questions. If they were researchers, they should be able to answer academic question. It was

because NBTC gave the money to those researchers”

“There was no technical detail of the base station released by NBTC or the mobile companies. Hiding this information was unfair for the public. The specification should be made accessible”

2nd interviewee: Supol Suksrimangmee - Independent Researcher

Problem	Cause	Moral Judgement	Solution
<ul style="list-style-type: none"> •Public was affected by the danger of EMF from the base stations installed in their residential area. •Many illnesses were caused by EMF released from the base stations. •Rising number in the cases of petition. 	<ul style="list-style-type: none"> •Hidden agenda •Ambiguity in the system •Information was hidden by the following actors <ol style="list-style-type: none"> 1. NBTC 2. KMITL’s researchers 3. Operators 	<ul style="list-style-type: none"> •Over exposing to EMF was dangerous. It was important to realize and protect the society from this radiation. 	<ul style="list-style-type: none"> •Giving information about the danger of EMF to the public •Raising public awareness •Waiting for the court to confirm the danger of EMF emitted by base stations

Expert Background

Mr. Suksrimangmee was a retired university professor in the faculty of Sociology and Anthropology at Khon Kaen University. He graduated with a bachelor’s degree in Law, two master degrees in public administration and international relations. He also used to work with Ministry of Interior. In the press conference, he participated as an audience. In the discussion session, he showed evidences such as the studies from other countries which suggested that EMF was the cause of several illnesses.

How was the danger of exposing to EMF emitted by base stations framed by experts?

Mr. Suksrimangmee claimed that he was affected by EMF that was released from the base stations installed on the roof top of his apartment. Headache and dazzle eyes were the symptoms he never had before. After finding out about the installation of base stations, he tried to find information about the danger of EMF released from the cell towers by himself.

“I: How do you come across this issue?”

“S: I was affected by EMF emitted from the base station. I am a sport man and never have any sign of illness before. After base station had been installed on the roof top of my apartment, I had a headache and also dazzle eyes. Finding out about the installation of base stations from two mobile company, Hut and AIS, I started to find information about the danger of EMF and health effects”

After finding information about the association between EMF exposure and health effects, he appealed to the court requesting for the removal of the base stations that were installed on the roof top of his apartment.

“After I found out about the danger of EMF, I went to apartment’s manager, sending the letter to NBTC, AIS, and Hut, asking them for removing the base stations from my apartment’s roof top. However, they did not listen to me. So I told the neighbour of my apartment about the danger of EMF emitted by base stations and then gathered the name list of those who were afraid of this dangerous radiation. They also had the similar symptoms such as headache and dazzle eyes. After that, I brought this name list to the court in order to appeal for the removal the base stations. Finally, they removed the base stations from my apartment”.

He strongly believed in the danger of EMF and adverse health effects. Moreover, he joined many activities about EMF and health risk issue such as conferences with the complaint public.

“Just told me, I will go to join the discussion because I knew the harmful effects of EMF”

“I could feel the EMF like in this room. It was WiFi that I could hear it, but it was not loud”

“Cancers and diabetes type2 also were caused by EMF”

He also played a role in giving advice for petitioners who appealed to the court requesting for the removal of the base station in their residential area.

“Someone came to me and asked for advice about petition for the removal of the base station. He tried to do it by himself, but it did not work. So I told him to go to the administrative court. After that, the base station was removed from his area.”

The danger of EMF emitted by base stations was framed as ‘cause of illness’ in which he reflected from his personal experience as ‘affected person’.

How do the experts conceptualize their own authority in providing authoritative and credible scientific advice?

According to his educational background in sociology, Mr. Suksrimangmee did not have specific knowledge about engineering. Instead of providing advice based on technical aspect of the EMF, he offered several academic papers from other countries as a source of knowledge claim in supporting his advice.

“There were several papers from other countries such as research from India, international news from Daily News (Thai newspaper), environmental health trust, research from Sweden, conference about EMF in China in 2017. Researches and academic papers from several countries, except Thailand”

He made a leaflet distributing in a crowded place. He also claimed that he was successful in helping the complaint public to win the case.

“I made a leaflet distributing to every crowded place. I used to distribute my leaflet to more than thousand people. Moreover, I joined the activities of public complains or seminar against the installation of base station in their living area. I was invited to be a speaker telling my experience in fighting about it. And I was successful

In this case, his authority in providing authoritative and credible scientific advice was stemmed from two sources. The first was academic papers supporting his claim about the danger of EMF. The second was his experience as the petitioner who succeeded in asking for the removal of the base stations.

How are boundaries between reliable and unreliable knowledge claim in health risk issue drawn by experts?

Besides his attempt in searching for information about the danger of EMF, he also mentioned a role of the other expert in Thailand who had the similar opinion. This person, dr. Sumeth, always sent him a useful information. It was a reliable source of knowledge that he could bring to the courts. He referred to several courts that he went to hand in the information about the danger of EMF. By doing this, he hoped that the court would officially proclaim to the public that EMF was dangerous.

“dr. Sumeth always sent me helpful source of information about the danger of EMF, which I brought it to the court. Moreover, he also sent me a scientific research which suggested that any level of EMF could cause adverse health effects in human”

How are the experts related to other societal actors?

Information about the danger of EMF was hidden from the public due to the hidden agenda among these actors: NBTC, KMILT's researchers, and mobile company.

"The danger of EMF was hidden from the public. NBTC tried to promote that living near to the base station did not cause any health effect. NBTC claimed that the level of EMF in Thailand complied with the international standard of ICNIRP. But it was not a standard, rather, it was a guideline. Furthermore, ICNIRP was supported by a private tele company."

"NBTC always said that it was not dangerous claiming the study from KMILT's researchers. They also held a seminar, inviting experts from other countries to be speakers"

"In Thailand the information was hidden because of the great influence of mobile companies"

He also mentioned that it was dangerous involving in this issue. Some people who used to fight against the base station were intimidated, and they gave up. But for him, he knew that it was dangerous but he insisted to do it because he felt that this was the right thing to do for other people in the society.

"If I ignored this issue, then what is going to happen in the future. I do the right thing because I knew about the danger and I was also affected by EMF of the base stations. I realized that it was dangerous. Some people were intimidated and then they gave up. But not me. I was never afraid of it"

3rd interviewee: Tatchai Pumpuang - KMILT researcher

Problem	Cause	Moral Judgement	Solution
<ul style="list-style-type: none"> •Public felt suspicious about scientific result produced by KMITL •Difficulty in changing what public already believed •Media published distorted information of KMITL's researchers •Public did not believe in the construction standard <p>Role of NGO</p> <ul style="list-style-type: none"> •Approaching public community faster than NBTC, persuading public to fear EMF emitted from base stations •Giving unreliable information to the public 	<ul style="list-style-type: none"> •Pubic lack of knowledge about EMF •A lack of standard in the construction of base stations made people fear of cell tower collapse •Different interpretation of engineering knowledge among experts 	<ul style="list-style-type: none"> •NBTC should get to the public before NGO, otherwise people will gain unreliable information. 	<ul style="list-style-type: none"> •Middleman might be helpful in compromising expert debate

Expert Background

Mr. Pumpuang was a professor at Rajamangala University of Technology Isan in the faculty of engineer. He had specialised knowledge in designing antenna as well as electro- magnetic radiation. Although he was one of the team of KMILT's researchers, he did not have particular interest about EMF and health risks. When he was studying his doctoral degree at Ladkrabang University in the faculty of engineering, his faculty was assigned by NBTC to perform the field site study, measuring EMF level in many regions of Thailand. In the press conference, he was one of the four delegates of KMILT's researcher team on the panel. Moreover, he also took part in the NBTC public forum as the delegate from KMILT's researcher team.

How was the danger of exposing to EMF emitted by base stations framed by experts?

According to a result of the field site study conducted by KMILT's researchers, he suggested that EMF radiation released by the base stations in Thailand was not dangerous because it did not exceed the international standard of ICNIRP. However, he did not reject a relation between EMF and adverse health effect. He claimed that the study on an association between EMF exposure and health risk required a decade of experiment in order for researchers to come to the conclusion. Therefore, what we could do was to comply with the standard. In that sense, the danger of EMF was framed in terms of 'possible' cause of illness which could be prevented by complying with the given standard.

“With the result of our study, the level of EMF in Thailand is 50-100 times less than what has been suggested in international standard. We said that it was far from what has been regarded as a dangerous level. What did you expect us to do. We are engineer and we follow the standard. We are not doctor. We cannot say that it is dangerous or not. Even a doctor he did not dare to confirm the danger because it takes time maybe a decade for the study to confirm that it is dangerous. Now there was no conclusion about the danger of EMF and health issue.”

Although the danger of EMF was framed as possible cause of illness which required a long term study, he considered other possible factors which might also cause a serious health problem such as coffee or pesticide used in Thai agriculture. These were more harmful than EMF.

“I knew that the level of EMF in Thailand did not exceed the standard. The problem was when people fear of something, they will not listen to any suggestion. EMF was less dangerous in comparison to drinking coffee, eating grilled pork. They had a higher level of carcinogen than EMF, why you were not afraid of them. Also pesticide used in Thai agriculture it was far more dangerous, why you were afraid of EMF radiation”

How do the experts conceptualize their own authority in providing authoritative and credible scientific advice?

Although he did not have particular interest about harmful health effects of EMF exposure, Mr. Pumpuang claimed that his specialization was about EMF. According to his study background as engineer having specialized knowledge of EMF, he could provide authoritative and credible scientific advice.

“I am a professor at Rajamangala University of Technology Isan in the faculty of engineer. My specialization was antenna designing as well as analyzing Electromagnetic. Therefore, EMF controversy was relevant to my specialization. My work was about wireless system. Not the data, but EMF”

How are boundaries between reliable and unreliable knowledge claim in health risk issue drawn by expert?

Mr. Pumpuang explicitly mentioned a role of NGO giving unreliable information to the public. According to the case study and suggestion provided by NGO, he considered it as unreliable knowledge claim due to a lack of effectiveness in an actual situation.

“NGO always approached to controversial area in public community faster than NBTC. NBTC did not properly response to the public complaint. They were slower than NGO. Although NGO told the truth, but it was truth only one side. For instance, a case in Italy that the court judged a case of public complaint over the removal of the base station. The result was that operators had to remove the base station. However, if we read through this case, it was not about base stations, but the operators clarify to the public about using mobile phone more than five hours could cause cancer. That means only base stations could not cause a cancer, but there was the second factor like using mobile phone. Mobile phone was actually sending a very high level of EMF because it was very close to us. NGO only pointed at base stations, regardless of the second factor like mobile phone. This made the public believed that the base station was dangerous”

“NGO suggested the use of microcell, releasing smaller amount of radiation. They gave an example of other countries that adopted this technology. The problem is they did not realise the fact that those counties using microcell were small islands, which were very different from Thailand in terms of geography. If we adopted microcell, it was very expensive. I did not side with operators, but if they cannot make profit from using this kind of technology, why would they do it”

How are the expert related to other societal actors?

- Non-governmental organization (NGO)

NGO was one of the actors that he mentioned as influencing how public perceived the danger of EMF. It provided unreliable information to the public such as the case in Italy in which NGO only gave one side of the story. Furthermore, it also recommended impossible solution of this problem such as the use of microcell.

- National Broadcasting and Telecommunication Commission (NBTC)

Mr. Pumpuang referred to NBTC as an authoritative regulator, responsible for ensuring the public whether EMF of the base station was harmful or not.

“NBTC was complained by the public regarding health risk of exposure to EMF. Therefore, they started to perform a field site study, and finally announced that it was safe. However, public felt suspicious and did not understand. Therefore, NBTC had to find the third party or academicians in order to ensure the public about this issue.”

However, he claimed that NBTC should approach the public faster than NGO, otherwise people would gain unreliable information and mislead by NGO.

“NGO always approached to controversial area in public community faster than NBTC. NBTC did not properly response to the public complaint. They were slower than NGO. Although NGO told the truth, but it was truth only one side”

4th interviewee: Thanet Patthanathadapong - KMILT researcher

Problem	Cause	Moral Judgement	Solution
<ul style="list-style-type: none"> •Public complaints and fear, requesting for the removal of the base stations •Engineering communicating to the public using technical words (doctor used softer words which made people understand) •Conflict of interest among public who lived near to the area of the installed base station. (Mobile company paid the money to the landlord in order to install the base station in his area.) (Other people who live nearby wanted to share the money, or wanted the base station constructed in their area so that they would be paid) •Mobile company did not comply with the regulation of base station installation. (Skip the process of public hearing) 	<ul style="list-style-type: none"> •Public lack of knowledge about EMF •Defect in regulation •Engineers explained in technical terms which affected the way public perceived the danger of EMF (Referring to the doctor who was able to give psychological explanation) 	<ul style="list-style-type: none"> •NBTC providing information and knowledge about EMF to the public would bring about the declination of complaints. 	<ul style="list-style-type: none"> •Information and knowledge about EMF should be given to the public •Operators (mobile company) should work together in order to install their base stations in the same area (Might be difficult to achieve due to benefits/interest)

Expert Background

Mr. Patthanathadapong was a professor at Ladkrabang University in the faculty of engineering. His specialisation was in Physics and communicative engineering, focusing on computer system and IT network. He participated in the team of KMITL's researchers because his faculty was assigned by NBTC to conduct the research on emitted level of EMF in several regions of Thailand. Although he did not go into the field site with other researchers, he partake in the press conference as one of the four delegates of KMILT's researcher team on the panel.

How was the danger of exposing to EMF emitted by base stations framed by experts?

According to the result of field site study, he claimed that the danger of exposing to EMF was not possible if we complied to the standard given by ICNIRP. In other word, he implied that there might be an adverse health effect regarding the information released by the World Health Organisation (WHO). Complying to the ICNIRP standard was the way to ensure that the public would be safe and that it was not dangerous to have cell towers in their living area. Furthermore, it is interesting to observe that he did not reject about the danger of EMF that might cause the adverse health effects, rather, he concerned that it took a long time before researchers could come to the conclusion about the danger of EMF and health issue. The danger of EMF was framed as the 'possible' cause of illness owing to the absence of scientific consensus on the relation between EMF and health risk.

Although he mentioned that ICNIRP standard could prevent the public from overexposing to EMF, he did not elaborate in detail about how this standard had been developed before using in the context of Thailand.

“EMF is everywhere, but the point is how people understand about it. When people did not understand, it caused the problem. Regarding the negative effect to human brain in long term or short term, researchers working on EMF and health risk discover that it is still not obvious. There is a standard set for mobile or cell towers, and with this limited level of EMF proposed by the standard, it is not dangerous”

“it takes time for the research to proof the danger so it might be impossible to get the answer whether it was dangerous or not. What we can say now is that with the standard given, it is not dangerous. In the future we might find other researches but we do not know, maybe it was not dangerous at all”

“the level of EMF that we measured from the field site did not exceed the standard, so it did not result in negative health effect”.

How do the experts conceptualise their own authority in providing authoritative and credible scientific advice?

Mr. Patthanathadapong claimed that he could give advice based on his engineering knowledge. However, he did not mention that he had specialized knowledge about EMF which was different from Mr. Pumpuang. Moreover, it was interesting to notice that he did not join in the field site study.

“According to the level of EMF that we have measured in several area of Thailand, it did not exceed the standard. This was the technical term reflecting from engineering perspective. But in terms of sociology, I recommended that you should try searching for other articles regarding this issue. It had the same meaning, but different way of explanation. It was important that you understood the nature of engineer, we always followed the technical terms. In comparison to those who were in other area of specialisation, they used softer words which made the public understood. This was what you should notice”

In this case, he referred to dr. Isaraphan who would be able to explain by using softer words in consideration of psychology.

“If you had a chance to talk to dr. Isaraphan, he could give you a very interesting explanation regarding how to understand the public in terms of psychology”

“I: Do you still involve in the debate about EMF and health effect?”

“P: Actually I rarely engage in the debate except this press conference. Dr. Piboon could explain better than me. As he worked with the Department of Disease Control, it was his responsibility to deal with public complaints.”

How are boundaries between reliable and unreliable knowledge claim in health risk issue drawn by experts?

Mr. Patthanathadapong did not mention any source of unreliable knowledge claim. Unlike Mr. Pumpuang, he did not refer to a role of NGO in misleading the public by giving unreliable knowledge source, rather, he mentioned NGO as taking side with the public in NBTC public forum. However, he did not join this public forum which was held in September, 2014.

“The NBTC public forum was such a heated debate. NGO came with the petitioners. We could only answer the question that was relevant to technical standard”

However, he suggested that reliable knowledge claim could be gained from information provided by NBTC so that the public would understand about EMF and health concern.

“NBTC tried to educate the public about EMF. There were activities and events where experts from NBTC would come to give information about this issue. I did not side with NBTC, but what they did was to educate the public about base stations, EMF, and harmful effects.”

“This is about how public understand technology. It is important that we always have to educate people about this issue”

How was the expert related to other societal actors?

- National Broadcasting and Telecommunication Commission (NBTC)

NBTC was referred to as authoritative regulator. It was responsible for those public complaints regarding detrimental health effects of EMF. He claimed that providing information to the public and educating them about EMF, base stations, and health concern would help in alleviating public fear.

“EMF is everywhere, but the point is how people understand about it. When people did not understand, it caused the problem”

“Educating the public was the most important thing. We could solve this problem but it has to begin with public understanding”

“When people understand, they know how to behave”

- Mobile company/ Operator

He mentioned the role of mobile companies/operators regarding how they did not follow the regulation.

“Before installing the base station in community area, you have to do the public hearing. If the public did not consent, you cannot install the base stations. It is important that the operators follow the regulation. In some cases, operators skip this process of public hearing, and they finally got in trouble.”

Regarding the solution to the problem of public complaints for base station removal, he suggested that operators should work together so that the base stations were installed in the limited and same area. However, it might be difficult due to benefits and interest of the companies.

“Nowadays, we can see base stations spreading in all area of Thailand. One thing that we can do is to compromise among operators so that their base stations are installed in the limited and same area. By doing this, we will not see the base stations in every building”

- Public Community

Public complaints about the danger of base station was considered by Mr. Patthanathadapong as a lack of public understanding about EMF.

“EMF is everywhere, but the point is how people understand about it. When people did not understand, it caused the problem.”

In addition, public fear about the danger of EMF was prone to be psychological feeling, for instance, when they saw the base station installed in their neighborhood, they were afraid of how this tower might cause negative impact from the emitted EMF.

“It was also psychological feeling. You have a space near to your house, but then the tower was installed. You don't see the space anymore, rather, the base station which make you feel worried about what it could emit”

5th interviewee: Piboon Isaraphan - Doctor in KMILT's team

Problem	Cause	Moral Judgement	Solution
<ul style="list-style-type: none"> •Rising number in the case of petitions •NBTC attitude in solving the problem (Public lack of knowledge) 	<ul style="list-style-type: none"> •Engineers did not use the softer word •Unreliable source of information used in the debate (misleading paper) •A lack of reliable academic paper (misleading paper) •Operators was the major cause of problem: lack of responsibility (Operators did not comply with the regulation) •Involving experts have different backgrounds •Different attitude between NBTC and the Ministry of Public Health 	<ul style="list-style-type: none"> •Operators should comply to the regulation. 	<ul style="list-style-type: none"> •NBTC should control the operators, instead of blaming the public for lacking of knowledge •In order to reduce the conflict of interest among the public, cooperative should be applied.

Expert Background

Mr. Isaraphan was a retired doctor working for the Ministry of public health in Thailand. According to his position in the Occupational and Environmental Disease in the Department of Disease Control, he was responsible for those public complaints regarding health issues. In the press conference, he was one of the four delegates from KMITL's researcher team on the panel. However, in this interview he claimed that he was an advisor, not a member of the team. Furthermore, he felt regretful participating in this team because he did not agree with the methodology in conducting a research. He did not mention in detail about the methodology. Instead, he claimed that this research was performed in terms of educating the public which he considered it as not an actual research.

"I: what is your role in KMITL's researcher team?"

"Is: I was just an advisor. Before the press conference I already suggested the team that it was low risk exposing to EMF, and they should not say that it was safe, but they did not follow my suggestion, and as you can see that this study was extensively controversial. I think that the methodology is not good enough, and I also think that I should not participate as the advisor.

"This research was more like giving information to the public, educating them about EMF. It was not an actual research. Just filling in the questionnaire, and measuring the level of EMF. I think it was not a research which help in solving the problem"

How was the danger of exposing to EMF emitted by base stations framed by experts?

The danger of EMF was framed as 'possible' cause of illnesses in human. He claimed that there was a relation between exposing to EMF and biological effects. However, little evidence has been developed regarding EMF as the cause of illnesses.

"I think in terms of biological study, it showed that EMF induced biological effects in human. However, there was little evidence showing the relation between EMF exposure causing illness in human"

"Due to the claim about the relation between exposing to EMF and cancers, there was little evidence about this. From the studies, nobody has been recorded as having a cancer from living near to the base station.

"Only those people who regularly used mobile phone were diagnosed to have ear cancer. However, in Thailand, people claimed that several kinds of cancer were caused by EMF of the base station such as ovarian cancer, breast cancer, or lung cancer"

In the absence of scientific consensus on the association between EMF and cancers, he was reluctant to ensure the public who claimed that they had cancers by living near to the base station. At the same time, he did not reject those claims about biological effects from exposing to EMF such as headache. However, he also mentioned that the number of people who biologically affected by EMF reduced after doing the provocation test.

“the claim about cancer was very weak. But in terms of biological effects, it was possible such as headache. However, due to the study by World Health Organisation (WHO), the number of people who claimed to be biologically affected by EMF drastically reduced after doing the provocation test. Those people who passed the test were prone to be sensitive to all EMF transmitters such as mobile phone, base stations, or fan. According to the claim about cancer, there was nothing new in Thailand. As I have talked with those people who claimed about health effect, only one person had cancer, but he claimed that he had cancer before the installation of base station”

He rendered a very interesting perspective in looking at how the danger of EMF was differently perceived between general public and petitioners.

“If you had your petition for something, although it was not dangerous, but it was a risk. Hence, in the world of petitioners everything was risk to some extent. Nothing was completely safe. So I used the word ‘lower risk’ as in the theory it was more acceptable in a sense that it was less dangerous”

How do the experts conceptualize their own authority in providing authoritative and credible scientific advice?

According to his position in the Occupational and Environmental Disease in the Department of Disease Control, he was responsible for public complaints regarding health concern. In other words, he worked closely with the cases of public complaints. Moreover, he claimed that he had a very good background on Physics, thus, he was able to work with these complaints about the base station. In that sense, he related his knowledge background in Physics to his authority in providing credible scientific advice.

“When people complained about their health issue, they would come to my department. and I am responsible for those complaints regarding illnesses caused by either environment or occupation. As I had a very good background on Physics, I am able to work with these public complaints about the base station”.

He also mentioned his partake in the number of conferences with NBTC and the public, but he did not provide the detail about which conferences that he joined. When there were public complaints

about the base stations, his responsibility was to talk with the public about their problem.

“I: Have you ever participated in any conferences, debates, or activities?”

Is: Yes, I used to participate in conferences with NBTC and the public. Particularly, I joined the conference with the public very often regarding their complaints about the base stations. Moreover, I was interviewed by the press and my interview excerpt was on the TV”

How are boundaries between reliable and unreliable knowledge claim in health risk issue drawn by experts?

Mr. Issaraphan mentioned unreliable academic paper used by someone in the debate of the press conference, however, he did not refer to the person who claimed this paper. Unreliable knowledge claim was therefore relevant to the credibility of the source of knowledge.

“In the press conference, someone claimed that the danger of EMF has been confirmed by the scientific paper from India. This paper shown that EMF could be the cause of illness in human. However, I have not read this paper before. It was a trick used by those opponents in the discussion about environmental threat. They will bring the paper without giving us a chance to read it beforehand. However, the paper was unreliable because it was just literature review, not a scientific research. This is the basic trick always used in the controversy. It was a political fight rather than academic fight”

How was the experts related to other societal actors?

- National Broadcasting and Telecommunication Commission (NBTC)

Mr. Issaraphan criticized NBTC’s attitude in solving the problem. He claimed that NBTC had a wrong attitude by considering a lack of knowledge among the public as the cause of the problem. NBTC tried to educate the public about EMF and health effects, claiming that it was not dangerous living near to the base stations. He suggested that the actual problem was not stemmed from public lack of knowledge about EMF, rather, it was because the mobile company/ operators did not follow the regulation of base station installation. In that sense, the mobile companies were regarded as lacking of responsibility.

“NBTC believed that the problem of public complaints about the danger of EMF was due to a lack of knowledge among public, which I also agreed in the first place because there was unreliable academic paper used in the discussion by opposite party in the debate. However, after I have been working with several cases, I realised that the actual problem was from the operators, lacking of responsibility in

complying to the regulation. And the burden was left with Ministry of Public Health”

“NBTC had several campaigns publicizing that it was not dangerous. However, it was important to consider the role of company. We have never had a serious talk with the company”

“The company installed the base stations regardless of conducting public hearing. What followed was public complaints, and then they let Ministry of Public Health solve the problem. It was impossible to solve as long as they are holding this attitude”.

Although he did not agree with NBTC’s attitude, working with NBTC had been a good experience for him.

“I did not agree with NBTC’s attitude. However, I was once used to work with them. We still had a good relation. But still, NBTC’s attitude was wrong”

“Although we have different attitude, we did not oppose against each other. I also learnt many things from working with NBTC”

- King Mongkut’s Institute of Technology Ladkrabang’s (KMITL) researchers

According to the engineering background of KMITL’s researchers, they did not use a softer words explaining to the public about the danger of EMF. Instead of using the word ‘not dangerous’ or ‘safe’, Mr. Issaraphan suggested to use the word ‘lower risk’ as it was more acceptable for the petitioners.

“KMITL’s researchers had engineering background. Engineers were less cautious for how they explain to the petitioners.”

Moreover, he also criticized the methodology that KMITL’s researchers used in the study. It was a reason why he regretted to be the advisor of the team.

“This research was more like giving information to the public, educating them about EMF. It was not an actual research. Just filling in the questionnaire, and measuring the level of EMF. I think it was not a research which help in solving the problem”

- Mobile company

He referred to game theory when the mobile companies gained their benefits in the losses of the public. In that sense, the companies would not intend to solve the problem, rather, they continued to install the base stations as many as they can, regardless of abiding by the regulation. Due to the auction contract with the government, they were able to install the base station in designated areas.

“I think the problem is now not getting any better. I believed that this was a game theory when the companies gained there benefit from installing the base station as many as they can. It was because they had the contract with government saying that base stations had to installed in the designated areas. Therefore, the companies believed that the more they could install the base stations, the less problems would occur”

“There would be less problem if they abided by the regulation. However, it was such a time consuming process to comply with the regulation before installing each base station, in which the companies might gain less benefit. Therefore, I think that game theory could explain this situation”

- Conflict of Interest among the public

When the base stations were installed in someone area, the mobile company paid money to the landlord. Other neighbors who lived near to the base station were irritated because they also wanted to share the benefit from living near to the base station. Mr. Issaraphan therefore suggested that ‘cooperative center’ should be established in order to collected the money from mobile company and shared among the public who also lived near the base station.

“Another way to alleviate the problem of public complaint was to set up a cooperative centre, where public in the area of installed base station could gain the money. The problem that we found after talking with the public was that the mobile companies only paid the money to the landlord who consented to have the base station constructed on his area. Other people who lived nearby were not paid”

“The landlord who owned the area of installed base station gained money, but other people who lived nearby gained nothing. They felt that they were also affected by having base stations near their houses”

6.2 Expertise & Regulatory Science

Experts in Controversy

In the past decades, the intensive discussion among scientists, political actors and lay public has been surrounding the issue of public health implications of exposure to artificial electromagnetic fields (EMF) from telecommunications and electric power technologies. In the case of EMF discussion in Thailand experts have come to play significant role in response to the pressing societal concern. However, the advice from experts is not conducive to the resolution of the problem since they disagree on the question of whether exposing to EMF cause negative health effects in human or not.

According to the rising number of public complaints about the danger of EMF of the base stations, NBTC, as regulatory authority in communicative industry of Thailand, assigns KMITL's researchers to conduct the field site study in several regions of the country in an effort to assure the public about whether it is harmful to have base stations installed in public residential areas. Nevertheless, the result of the field site study has been extensively controversial. In this section the controversy over the danger of EMF among involved experts who participated in the press conference held by NBTC in July, 2014 will be discussed.

Experts, who partake in the press conference have shown different opinions regarding the danger of EMF emitted by the mobile phone base stations. They become involved in the controversy over scientific and technical issues that have social, political and economic implication (Martin and Richards, 1995); "many of them become involved not just as consultants or providers of expertise but as overt and committed defenders or opponents of one side or the other, as active participants the debate" (p.506). On the one hand, KMITL's researchers render their advice to the public, claiming that the level of EMF emitted by base stations did not exceed the ICNIRP standard, which cause no harmful effects in human. On the other hand, independent experts, who are the opponents and active participants in the discussion, argue that exposing to EMF is dangerous. Depending upon the disputes among experts, it provokes difficulties for decision making and policy implementation (Martin and Richards, 1995).

Regulation and Challenges

Given the rising number of mobile phone base stations in many areas of Thailand, the inhabitants living in the base stations vicinity are afraid of the danger of EMF radiation released by these masts. In order to allay the fears among citizens, the regulatory measure has been adopted. Therefore it is thus vital to consider how the regulation has been criticized by involved experts. In this section I will discuss what challenges are conceived by the experts in an effort to achieve the effective regulation.

Independent researchers, Mr. Maleewan and Mr. Suksrimangmee, refer to negative role of NBTC, an authoritative regulator of this industry, as involved in the hidden agenda with KMITL's researchers and mobile company. NBTC as a regulatory body has been regarded as serving the benefit for mobile industry, not the public. They are suspicious about a large amount of budget allocated to this research project which has been performed only in six months. In that sense the role of NBTC has been criticized for its lack of transparency which raises the question about whether this regulatory body is credible and capable of implementing effective regulation.

While independent researchers show their confidence on the association between adverse health consequences and EMF exposure, reflecting from their experience as 'affected person', it has been argued by KMITL's researchers regarding the absence of scientific consensus on the negative health effects from exposing EMF radiation. Due to the uncertainty of the available knowledge on the potential health effects of EMF exposure, experts are reluctant to confirm the danger of EMF released by the base stations. Nevertheless, experts from KMITL have shown different opinions regarding this issue.

Two engineers, Mr. Pumpuang and Mr. Patthanathadapong, claim that it is difficult to ensure the public that they are affected by emitted EMF from the base stations owing to the absence of scientific consensus. Moreover, they suggest that it takes time before researchers are able to conclude that whether exposing to EMF is harmful or not. In that sense these two engineers do not reject the danger of EMF, rather, they frame it as 'possible' cause of illnesses in human. Therefore, they suggest that complying with ICNIPR exposure guideline is the way to make sure that the public are safe although the base stations are installed close to their houses. This perspective lead them to consider that public complaints are due to their lack of knowledge about EMF. In that sense, a lack of knowledge among worried citizens has been considered as the impediment for an effective regulation. (Relate to Stilgoe argument about UK)

On the other hand, a doctor in KMITL's researcher team, Mr. Issaraphan, claims that although little evidence has been developed regarding EMF as the cause of illness in human, biological effects from exposing to EMF such as headache have been concerned in several academic papers. However, in

order to achieve a good regulation, he suggests that mobile company should abide by the rule of base station installation. In that sense, a good regulation can be achieved by shifting the focus from a lack of knowledge of the public to a lack of responsibility among operators.

6.3 Boundary Work

Among the four elements of boundary work; expansion, monopolisation, exclusion, and protection of autonomy, three of them are considered as relevant to the case study; monopolisation, exclusion, and protection of autonomy.

Monopolisation and exclusion is the idea that monopolisation of professional authority and resources has been achieved by excluding others claiming that they are ‘pseudo’, ‘deviant’, ‘amateur’ (Gieryn, 1983). This notion can be used a lens to investigate how the independent researchers claim that the study produced by KMITL’s researchers is unreliable. According to the independent researchers’ claim about the ambiguity in the system, there is a hidden agenda among NBTC, mobile companies, and KMITL’s researchers. Furthermore, Mr. Maleewan also points at a lack of specialised knowledge among KMITL’s researchers, which is considered as producing unreliable knowledge. In that sense, the independents researchers maintain their professional authority though the claim about hidden agenda and a lack of specialised knowledge of the other party. On the other hand, Mr. Issaraphan refers to his experience in working closely with the cases of public complaints, and therefore claims that NBTC holds wrong attitude towards the problem. The problem is not about a lack of knowledge among the public, rather, it is a lack of responsibility of those mobile companies when they did not abide by the regulation of base station installation.

Protection of autonomy refers to how science is protected by putting the blame on scapegoats from outside (Gieryn, 1983). This notion can be observed from the role of KMITL’s researchers through how they mention the relevant societal actors as the ‘scapegoat’ in an attempt to protect their autonomy. According to the role of NGO, Mr. Pumpuang claims that NGO provides unreliable information to the public, misleading them to believe in the danger of EMF. Media also plays vital role in distorting the information that he said in the conference. Furthermore, Mr. Pumpuang and Mr. Phattanadapong point at how the EMF emitted by base stations is less dangerous than drinking coffee, using pesticide in Thai agriculture, or using the mobile phone in everyday life. Furthermore, they also refer to a lack of knowledge among the public about EMF.

8 Conclusion

The intensive discussion among scientists, political actors and lay public over the danger of EMF released from the base stations has been lingering for more than a decade in Thailand. Experts are requested to provide their technical advice based on their technical expertise regarding the public concern for implications of technological advances (Nelkin, 1971). In the case of controversy in Thailand, KMITL's researchers provided technical advice based on the field site study, claiming that it is not dangerous to live close to the base stations. However, this claim has been pervasively criticised by the worried citizens and other experts. In that sense, expert advice has become suspicious when they are no longer conceived by the public that their advice has been delivered in a value-free manner (Jasanoff, 1990). The grand narrative of expert advice that science can speak truth to power has been challenged by the contribution from Science and Technology Studies (STS) in the study of expertise (Stilgoe, 2016).

Independent researchers and KMITL's researchers play a role in this controversial context as advisors. They have shown different opinions regarding the danger of EMF. According to the societal actors addressed by experts, it opens up how experts tend to deliver their advice based on elements of science, society, and politics (Jasanoff, 1990). Independent researchers claim that there is a hidden agenda among NBTC, KMITL's researchers and mobile company. KMITL's researchers, on the other hand, refer to a lack of understating among the public, negative role of NGO, as well as a lack of responsibility of operators. The way that experts related to these societal actors underscores the character of expert doing 'regulatory science' when political neutrality of experts has been refused, thus, experts has been perceived as playing constructive role in the construction of policy (Jasanoff, 1990; Stilgoe, 2016). As Jasanoff (1990) suggests, in the context of decision-making, experts rarely restricted to the purely technical issue. They are not delivering science in ordinary sense, or performing a linear model when science is presumed to be autonomous and value-free (Stilgoe, 2016), rather, it is a hybrid activities "[...] that combines elements of scientific evidence and reasoning with large doses of social and political judgement" (Jasanoff, 1990, p.229).

In the absence of scientific consensus over the danger of EMF of the cell towers, KMITL's researchers, Mr. Pumpuang and Mr. Patthanathadapong, claim that adhering to the ICNIRP guideline would not result in the harmful effects of EMF exposure. Furthermore, they suggest that public should be educated about EMF and health effects in order to alleviate the fears among the public. However, in the context of controversy, the involvement of experts in public disputes leads to a lack of confidence in the power of expertise (Limoges, 1993). In that sense, educating the public in order to prevent the eruption of the controversies has been considered as inefficient when merely considering unidirectional communication and bilateral communication (Limoges, 1993).

In order to cope with the controversy, he suggests that all the actors involved in the controversies should be taken into a serious consideration. This highlights the importance of ‘the worlds of relevance’ which represent in and constitutive of controversy (Limoges, 1993). In the controversies space, KMITL’s researchers play a role as consultants or providers of expertise, while independent researchers perform their role as overt and committed defenders or opponents of one side or the other (Martin and Richards, 1995). According to the disputes among experts, it shows that experts are not always on the same side (Limoges, 1993) which provokes difficulties for decision making and policy implementation (Martin and Richards, 1995). Every actor in the worlds of relevance has been considered as significant dynamics of public controversies, in that sense, they represent different definition of issues and stakes of the controversy (Limoges, Cambrosio, Avignon, 1995). The diversity of frame made by involved experts regarding the danger of EMF displays how each world of relevance involved in the controversy. In order for experts to be provided with their credibility in the controversial context, expertise should not be understood as the property of individual expert, but ‘ongoing learning process’ which derives from the interactions between participants in the controversy (Limoges, 1993). According to the case of experts in Thailand, the learning has not yet occurred. Experts tend to deliver their advice based on their own expertise, regardless of taking all actors in the worlds of relevance into consideration.

This notion is considered as relevant to the case of controversy among experts in Thailand. By using the notion of ‘monopolisation and exclusion’, the claim made by independent researchers can be investigated through this notion when they disagree with the result of study conducted by KMITL’s researchers, and suggest that KMITL’s study is unreliable. Regarding the question of ‘how are the boundaries between reliable and unreliable knowledge claim in health risk issue drawn by experts?’, it can be examined by using the notion of monopolisation and exclusion

Proposed Solution

Considering the case of controversy over the health risks of mobile phones in the context of UK (Stilgoe, 2016) and mobile phone risks in Sweden (Soneryd, 2007), the coproduced technical uncertainties should be considered in order to understand science and the public. In the case of controversy in UK Independent Expert Group on Mobile Phones (IEGMP) “[...] reframed science in terms of experimentation as well as evidence... invited non- experts into the experiment...did not presume a static view of public opinion” (p.8). In Sweden, public dialogue practice has been put forwards by the Swedish Radiation Protection Authority (SSI), admitting uncertainties and striving for controlled research and qualified reassurance rather than ignorance (Soneryd, 2007). These two cases offer an interesting perspective of how the organisation of regulatory body can be changed towards a more open and responsive organisation (p.310). Science-as-experiment has been introduced instead of science-as-expertise (Stilgoe, 2016).

According to the uncertainty of the available knowledge regarding the danger of EMF exposure which has been discussed internationally and nationally, there is no concrete agreement among experts to this pressing societal concern. The negotiation between science and policy in making regulatory decision has been produced in the grey zone between science and policy, or facts and values. Therefore, it is important to notice from sociology of science arguing that “the creation of scientific knowledge is much less objective and methodologically controlled” (Jassanoff, 1995, p.281). In that sense, the controversy cannot be closed when expert advice has been positioned as neutral and seeking closure (Stilgoe, 2016). Taking the case of controversy from the context of UK and Sweden as mentioned above, it offers a nuanced perspective in dealing with the issue of uncertainty. These two cases suggest that ‘science-as-expertise’ will not yield a solution to the pressing problem. Rather, moving towards ‘science-as-experiment’ has been regarded as effective way of dealing with the uncertainties (Stilgoe, 2016).

The core idea is to accept all uncertainties as well as public opinion into the consideration of advisory practice. This implies that lay knowledge should not be neglected in the controversial context. As suggested by Soneryd (2007), public dialogue allows the decision makers to “to maintain their existing policies and regulations, while claiming to be responsive.” (p.309). I consider this perspective from Stilgoe (2016) and Soneryd (2007) as producing a possible solution for the lingering disputes in controversial context of base station in Thailand. NBTC as regulatory body should not presume a static view of the public opinion as not educated enough. Rather, this organization should admit that there is the uncertainty of available knowledge as the most vital dynamics in the controversy. Seeking expert advice as the end of discussion with the public and as the solution to this societal problem has been proved to be ineffective as noticeable from the still rising number of public complaints. Hence, encouraging the articulation of public concern in the advisory and regulatory process is worth to take into account when striving towards the solution.

In this last section I would like to suggest the further direction of study in the future. The focus of this project is on the role of expert in a controversy over the danger of EMF emitted by the mobile phone base stations. The diversity of frame made by those involving experts is the core analytical focus of this study. In that sense, the aspect from the lay public partook in the conference or those people who petition for the removal of the base stations has been silent. Therefore, it might be interesting to further expand from what I have already suggested towards how public is constructed by experts. Moreover, the context of lost credibility in scientific advice can be a foreground in examining the perspective from lay public and the analysis on the intertwinement of science and society that can be studied through the concept of co-production, seeing scientific controversy as featuring co-produced scientific and social order.

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Abstract

In Thailand the controversy over the danger of EMF released by mobile phone base stations has been discussed for a decade. With the increasing number of public complaints requesting for the dismantle of the base stations installed in public vicinity, experts became involved as science advisors in response to the pressing societal concern. This master thesis focuses on the role experts in a controversy over Electromagnetic Fields (EMF) related health risk issue in the context of Thailand. It examines how involved experts differently frame the danger of exposing to EMF emitted by mobile phone base stations in the press conference held in 2014. I consider the diversity of frames produced by involving experts in a controversy as the central aim of the study. The analysis relies on the backdrop of regulatory science in order to conceptualize the role of experts as advisors.

Given the role of experts as advisors in this controversy, it is evident that they cannot close the controversy when their advices have been positioned as neutral and seeking closure (Stilgoe, 2016). According to the contribution of Science and Technology Studies (STS), the concept of regulatory science offers a useful perspective to understand the role of experts by taking into account that “the creation of scientific knowledge is much less objective and methodologically controlled” (Jasanof, 1995, p.281). Their advices have not been delivered via speaking truth to nature (Jasanoff, 1995), rather, as Jasanoff (1990) offers, experts have become involved in a hybrid activity comprising of “[...] elements of scientific evidence and reasoning with large doses of social and political judgement” (p. 229).

In the final section of this master thesis I offer the proposed solution, learning from the similar controversy in the context of UK (Stilgoe, 2016) and Sweden (Soneryd, 2007). NBTC as regulatory body should not presume a static view of the public opinion as not educated enough. Rather, this organization should admit that there is the uncertainty of available knowledge as the most vital dynamics in the controversy. Seeking expert advice as the end of discussion with the public and as the solution to this societal problem has been proved to be ineffective as noticeable from the still rising number of public complaints. Hence, encouraging the articulation of public concern in the advisory and regulatory process is worth to take into consideration when striving towards the solution.

Abstract

Die Kontroverse um die Gefahr von elektromagnetischen Feldern (emF), die von Mobilfunk-Basisstationen produziert werden, wird in Thailand seit einem Jahrzehnt diskutiert. Als Reaktion auf die zunehmenden Beschwerden, welche die Entfernung der Basisstationen aus dem öffentlichen Raum forderten, wurden ExpertInnen als wissenschaftliche BeraterInnen hinzugezogen, um der drängenden gesellschaftlichen Besorgnis Rechnung zu tragen. Diese Masterarbeit konzentriert sich auf die Rolle der ExpertInnen in einer Kontroverse über emF im Zusammenhang mit Gesundheitsrisiken im Kontext Thailands. Sie untersucht, wie die involvierten ExpertInnen die Gefahr der emF-Belastung durch Mobilfunk-Basisstationen während einer 2014 abgehaltenen Pressekonferenz unterschiedlich rahmten. Das zentrale analytische Interesse dieser Arbeit liegt auf der Unterschiedlichkeit dieser Rahmen, wobei Regulatory Science den Hintergrund zur Konzeptualisierung der Rolle der ExpertInnen als BeraterInnen bildet.

Angesichts der Rolle der ExpertInnen als BeraterInnen in dieser Kontroverse ist es offensichtlich, dass sie die Kontroverse nicht schließen können, wenn ihre Ratschläge als neutral positioniert sind und eine Schließung anstreben (Stilgoe, 2016). Dem Beitrag von Science and Technology Studies (STS) zufolge legt das Konzept der Regulatory Science nahe, dass ExpertInnen, wenn sie die Rolle als Berater wahrnehmen, nicht in der Lage sind, ihre Beratung auf der Grundlage einer reinen Wissenschaft abzugeben, sondern von mehreren Faktoren durch die Dynamik der Kontroverse beeinflusst werden (Jasanoff, 1990). Im Falle der Kontroverse in Thailand beeinflussen persönliche Erfahrungen, akademische Hintergründe und ihr Verhältnis zu anderen gesellschaftlichen Akteuren die Art und Weise, wie Experten die Gefahr von EMF rahmen und ihre unterschiedlichen Meinungen und Ratschläge zu einem solchen Thema abgeben.

Mit Bezug auf ähnliche Kontroversen im Kontext von Großbritannien (2016) und Schweden (Soneryd, 2007), biete ich im letzten Abschnitt einen möglichen Lösungsansatz an. Als Regulierungsbehörde sollte NBTC die statische Sicht auf die Öffentliche Meinung als zu wenig gebildet vermeiden. Stattdessen sollte diese Organisation Unsicherheiten im verfügbaren Wissen als Kernelement der Kontroverse anerkennen. Die Suche nach dem Ratschlag von ExpertInnen als Ende einer Diskussion mit der Öffentlichkeit und Lösung des sozialen Problems hat sich als ineffektive herausgestellt, wie die zunehmende Zahl an Beschwerden belegt. Demzufolge lohnt es sich, die Artikulation von öffentlicher Besorgnis in Beratungs- und Regulierungsprozessen anzuregen.