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Media and public opinion on nuclear power in South Africa prior to and after the Fukushima nuclear disaster of 2011

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DECLARATION

I, **Tshakane Tshepe,** declare that the mini-dissertation hereby submitted in partial fulfilment of the Master's Degree in Business Administration is my own work and has not been previously submitted by me for any degree at any University. It is my own work in design and execution. The material contained herein has been duly acknowledged.

July 2015

Signature **Date**

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I would like to thank my supervisor, Prof. Collins Miruka for always providing me with positive and encouraging feedback.

Prof. Victor Tshivhase is acknowledged in kind for reviewing this work. Ruth Nicola is thanked for editing this report and making sure that it is written in English.

In the present age there is a strong possibility that the animal species may find this research work useless, meaningless and irrelevant. It is therefore dedicated to those who strive selflessly to do good for mankind.

Madume go ba ntlu yame le botlhe ba ba direlang Modimo go ya bokhutlong jwa nako. Tshegofalang mo Moreneng!

ABSTRACT

The nuclear disaster at Fukushima Daiichi Nuclear Power Plant in Japan has evoked a massive discourse on nuclear issues in South Africa and elsewhere. This study analyses media framing of the nuclear debates in the South African media before and after the accident. Over 156 articles published in the *Mail and Guardian*, *The Sunday Times*, *Witness* and the *City Press* newspapers were examined. Taken collectively, these articles represent a good snapshot of the print media coverage on nuclear debates in South Africa for the period 11 March 2010 to 11 March 2012. That is a year prior to the nuclear accident and a year after the accident. The Fukushima Daiichi accident has forced the two opposing camps to redefine their discourse in response to challenges and questions brought about by the accident.

The statement of the problem that the research work intends to address is derived from the following background. There is limited factual information about nuclear technology that the public can freely access in order to make informed decisions. The public relies mainly on media to gain nuclear knowledge. In turn, the media use framing to influence and shape perspectives, public awareness and understanding, as well as to channel discussions on topical nuclear issues. As a result, information on nuclear technology has been distorted and frequently misrepresented, resulting in a shift in public perception, opinion, attitude and acceptance towards this technology. The extent of such a paradigm shift is investigated in this research work, through the following research questions:

RQ1: To what extent has the Fukushima Daiichi nuclear accident altered narratives about nuclear power technology in South Africa?

RQ2: Does the Fukushima Daiichi nuclear accident serve as a benchmark to report on nuclear power technology in South Africa?

RQ3: Which types of sources or frames are being promoted or portrayed in the media?

RQ4: Are there any differences in media coverage between conservative and liberal media outlets with regard to nuclear policy change in South Africa?

The aim of this study is therefore to critically explore the language or frames through which nuclear discourse is reported in the following South African print media and to

interrogate the ideologies underlying the philosophies of these newspapers. A qualitative method was used to analyse the information published in the four above named newspapers. Before the accident, most of the articles espoused pro-nuclear themes, highlighting the inherent importance of nuclear energy to South African economic growth, security of energy supply and superior competence of the technology.

After the accident, the study shows a paradigm shift on the part of the pro-nuclear activists towards a neutral but conservative position, balancing advocacy of nuclear progress with consideration of important lessons to be learned for future nuclear expansion programmes. The voice of the anti-nuclear movement received more traction after the accident, focusing mainly on the controversial issues, such as lack of infrastructure to deal with the high level of radioactive nuclear waste, huge discrepancies in estimating the cost of nuclear development and so on. However, the voice of anti-nuclear activists has attracted less attention in comparison to the pro-nuclear voice, led, interestingly, by governmental officials.

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

CSF	Critical Success Factors
DOE	Department of Energy
IAEA	International Atomic Energy Agency
IRP	Integrated Resource Plan
M&G	*Mail and Guardian* newspaper
Necsa	South African Nuclear Energy Corporation
NNR	National Nuclear Regulator
PBMR	Pebble Bed Modular Reactor Project
ST	Sunday Times

TABLE OF CONTENTS

CHAPTER 1

Introduction and overview of study

1.1 Introduction

The media play a critical role in producing and distributing information, as well as offering commentary about current affairs that may be considered to be of general public importance and interest (Perko, Turcanu, Mamani and Van Rooy, 2011:10). The way in which the media decide to develop, produce and portray a story is called media framing. Therefore, framing is a media-constructed reality in which public opinion on issues, controversies, disagreements, and some aspects of perceived reality, are given a particular interpretation to promote or demote a specific point of view (Entman, 1993:51-58). Nuclear power, like any debatable policy issue, has its own deep-rooted culture. This culture is, however, mostly shrouded in a veil of secrecy, fear, misinformation and mistrust (McCarthy, 2011; Faull, Sole and Brümmer, 2015).

The aim of this report is to present the content analysis of nuclear power discourse in the South African print media, before and after the nuclear accident at the Fukushima Daiichi Nuclear Facility in Japan. The research objective is to understand how the media coverage and presentation of nuclear power has trended as a result of the Fukushima Daiichi nuclear disaster. It is accepted that major accidents of such a nature as Fukushima Daiichi can have significant impact on the media coverage of nuclear technologies, which in turn may influence public opinion and perception about them (Venables, Pidgeon, Parkhill, Henwood and Simmons, 2012:371-383; Gamson and Modigliani, 1989:1-37).

For this study, it is important to understand the media presentation of nuclear energy in news coverage over a sustained period of time and how the media influences and shapes public opinion (Hallahan, 1999:205-242). The research is limited to the following time period: 10 March 2010 to 10 March 2012: that is, reporting a year before the Fukushima Daiichi accident, and a year after the accident of 11 March

2011. However, to investigate media developments and trending, the study will be extended to cover nuclear discourse and reporting up to the current date.

1.2 Historical Background

On 11 March 2011, a massive earthquake, which measured a magnitude of 9.0 on the Richter scale, followed by an unprecedented 14 metre tsunami, led to a meltdown of three nuclear reactor cores at the Fukushima Daiichi Nuclear Power Plant (NPP) in Japan. The Fukushima nuclear catastrophe received a great deal of coverage, including in South African media – a country where the use of nuclear power has been seriously questioned and debated since the construction of the Koeberg Nuclear Power Station (Adams, 2012:42-48; Necsa, 2011; NNR, 2012). In South Africa, about 5% of electricity is generated using nuclear power (WANO, 2015). The South African government plans to build more nuclear plants that would contribute between 13 and 25% of total electricity by 2030 based on the nuclear expansion framework provided in the Integrated Resource Plan (IRP) of 2011 (IRP, 2011:9).

The Fukushima Daiichi nuclear accident has had strong ramifications well beyond Japan, leading to the re-evaluation of nuclear agendas and policies across the world (Jorant, 2011). Germany has taken a strong stance to dramatically phase out nuclear power by 2022 subsequent to the Fukushima accident. This decision by the German government is due to massive and intense public opposition and demonstrations against continuing use of nuclear power (BBC News, 2011). Similar demonstrations were also commonplace in Japan, especially when the government wanted to restart the operations of other temporarily closed power plant facilities (see Poortinga, Aoyagi and Pidgeon, 2013:1204-1211, and references therein).

A number of authors performed content analysis on media reporting just after the Fukushima nuclear disaster, albeit from different angles. Perko, Turcanu, Geenen, Mamani, and Van Rooy (2011:10) carried out research on the media coverage and framing of nuclear energy soon after the Fukushima disaster. Their work focused mainly on the roles and functions of media in shaping and influencing the view of the public about the accident associated with nuclear power. According to Perko *et al* (2011:10), the role of media serves as a “link between the emergency actors and the

risk perception among the population". Such a role was found to be crucial in the relationship between government and public, mainly in the shared construction of cultural meanings, risk perception and risk communication of nuclear power (Oltra, Romas and Prades, 2013:1-64).

The Fukushima Daiichi nuclear disaster, like other major nuclear accidents such as Chernobyl in Russia and Three Mile Island in the USA (Friedman, 2011:55-65), became a central point for media debates with regard to the safe use of nuclear technology. According to Sood, Stockdale, and Rogers (1987:27-41), media attention on particular risk-related issues can be precursors to policy change, and the direction of that change is moulded and strongly influenced by how the media frames it, and by allowing new viewpoints to compete against prevailing narratives (Gamson and Modigliani, 1989:1-37). The media therefore plays an important role in choosing which stories and viewpoints need to be portrayed to the public, based upon the information and the authoritative sources that authors draw the content of their stories from (Parenti, 1997; Desai, 2012:2).

Gamson and Modigliani (1989:2) were the first authors to investigate media framing of nuclear energy using what they described as "media packages". The text of the media package is made up of paraphrased passages and direct quotes from a number of references or sources. For instance, in developing a media package for a frame that describes nuclear power in terms of progress, Gamson and Modigliani examined language from pamphlets, opinion letters and other writings by advocates of nuclear power. They pointed out that this kind of package offers a number of different condensing symbols that suggest the core frame and positions in shorthand, making it possible to display the package as a whole with a "deft metaphor, catchphrase, or other symbolic device… that characterised the metaphors" (Desai, 2012:3). Examples of frames such as "developing nations can especially benefit from peaceful uses of nuclear energy" or "Nuclear power is necessary for maintaining economic growth and our way of life" were analysed. Gamson and Modigliani (1989:11) argued that there are always competing interpretive packages available within the nuclear culture.

1.3 Background on Nuclear Power in South Africa

To date, the only commercial nuclear power plant operating in South Africa is the Koeberg Nuclear Power Station (KNPS) in the Western Cape. Koeberg utilises a Pressurised Water Reactor (PWR) design, commissioned by Framatome (now Areva) in 1976. Koeberg is surrounded by 3000hectares of land, mostly made up of game reserve fully owned by Eskom, in which over 150 species of birds and some mammal species reside. The radioactive waste generated in KNPS is transported by road to Vaalputs disposal site, secured in steel and concrete containers. Vaalputs is located about 600km from the KNPS in the Kalahari Desert. The high level waste and fresh spent fuel, are, however, stockpiled on site in specially designed cooling pools. According to Eskom website (Eskom, 2014), KNPS ranks amongst the most reliable and the safest Pressured Water Reactors currently operated across the world. The Eskom website further highlights the achievements of the KNPS. Koeberg was awarded National Occupational Safety Credited Awards (NOSCAR) status in March 2001 for the 5th time since its commissioning by the National Occupational Safety Association (NOSA). The KNPS supplies about 5% of the electricity to the national grid (Eskom, 2014).

South Africa also has a 20 MW thermal research reactor, known as SAFARI-I reactor which is used mainly to produce radio-nuclear isotopes for medical purposes. SAFARI-1 is located at the South African Nuclear Energy Corporation (Necsa) in Pelindaba, North West (Necsa, 2014).

The Pebble Bed Modular Reactor (PBMR) is a high temperature gas-cooled nuclear reactor that uses chemically inert helium gas as a coolant. It belongs to the fourth generation of high temperature reactors, of which a few archetypes have been decommissioned or are in process of decommissioning (IAEA, 1999). The PBMR project was to be constructed to supplement coal-fired power stations across the country with the aim of relieving the electricity demand that operated close to full capacity. The PBMR project has since been placed under care and maintenance by the South African government, with the preferred option of constructing more coal-fired power stations such as Medupi and Khusile power plants (Eskom, 2014).

1.4 Radioactive Waste management in South Africa

One of the central but most highly controversial issues that generate public discourse about the use of nuclear technology is the management of radioactive waste. The reason is that radioactive waste can impact negatively on people's health and/ or result in long-term environmental damage (IAEA, 1999). In South Africa, radioactive waste management is administered under the provisions of the following Acts: (i) The Constitution of the Republic of South Africa (Act no. 108 of 1996); (ii) Nuclear Energy Act (Act no. 46 of 1999); (iii) Dumping at Sea Control Amendment Act (Act no. 73 of 1995); (iv) National Nuclear Regulator Act (Act no. 47 of 1999); (v) Hazardous Substances Act (Act no. 15 of 1973); (vi) National Water Act (Act no. 36 of 1998); (vii) National Environmental Management Act (Act no. 107 of 1998); (viii) Environment Conservation Act (Act 73 of 1989); and National Radioactive Waste Disposal Institute Act (Act 53 of 2008).

The South African government has provided a framework on the use of nuclear power (based mainly on the IAEA nuclear safety series (IAEA, 2015) and outlined the government responsibilities (South African National Government, 2008:18) to: (a) ensure that cost calculations for nuclear power shall be based on the full value chain of the nuclear fuel cycle, including decontamination, decommissioning and waste disposal; (b) define the national policy on decommissioning, the management of the resulting radioactive waste, and making the disposal site available for long-term waste storage; (c) define the legal framework, financial and technical responsibilities of organisations to be involved in decommissioning and land restoration; (d) ensure that the appropriate technical and scientific expertise is always available for planning and implementation of decommissioning programme, including the sustenance of independent regulatory functions; and (e) establish a mechanism to provide and ensure adequate financial resources to carry out a safe and timely decommissioning programme.

Based on the above framework, the South African government developed the radioactive waste management policy in which the following principles have to be realised (information taken from the Radioactive Waste Management Policy and Strategy for the Republic of South Africa, (RWMPS, 2005:8)): (1) Protection of human

health - radioactive waste is to be kept below levels that threaten human health; (2) Protection of the environment - radioactive waste is to be kept below levels that could permanently damage the environment; (3) Protection beyond national borders - radioactive waste to be contained in a way that neighbouring countries would not be impacted; (4) Protection of future generations - radioactive waste is to controlled in such a way that future generations would not be adversely impacted; (5) Burden on future generations - radioactive waste shall be administered in a way that it would not bring undue burden to future generations; (6) National legal framework - radioactive waste shall be governed within applicable national legal framework; (7) Control of radioactive waste generation - generation of radioactive waste shall be restricted to lowest acceptable levels; (8) Radioactive waste generation and management interdependencies - interdependencies in radioactive waste generation will be put in place; and (9) Safety of facilities - the safety of facilities shall be assured for the entire lifespan of the waste facilities

1.5 Factors that may induce strong media debate on the use of nuclear power

The PESTEL factors (defined below) can be seen as positive indicators or as constraints. The applications of these PESTEL factors are mostly dependent on conditions and types of nuclear institutions, but may differ from one country to the next. PESTEL stands for Political, Economic, Social, Technological, Environmental and Legal. A brief consideration of how PESTEL factors influence nuclear discourse is presented: (i) Political: Some occurrence of a serious accident within a nuclear facility might precipitate adverse changes in the government's nuclear policies, or future governments might not be in full support of nuclear programmes; (ii) Economic: When the plant becomes unprofitable due to day-to-day running costs, or when refurbishments and restart of a facility are too costly to justify; (iii) Social: When society does not see any direct benefit to their social and material wellbeing, infrastructure development, safety and security; (iv) Technological: When upgrading out-of-date equipment and/or phasing out obsolete technology in order to comply with new safety standards and regulations cannot be justified economically; (v) Environmental: When there is permanent damage to the environment and the eco-system; and (vi) Legal: When changes take place to a country's legislation in an effort

to align the country with global trends or influences on the use of nuclear power technology.

1.6 Statement of the problem

There is scarcity of information on nuclear technology, especially with regard to infrastructure development cost, affordability, nuclear proliferation, waste management, sabotage, terrorism, risks of nuclear disasters, nuclear policies, public acceptance, and so on. Media uses framing to influence and shape perspectives, public awareness and understanding, as well as to channel discussions on these topical issues. As a result, information on nuclear power technology had become distorted and frequently misrepresented, causing a shift in public perception, opinion, attitude and acceptance towards this technology in South Africa. To turn the situation around, the public could adopt a proactive and participatory approach in acquiring nuclear knowledge in order to assess and determine the level of bias in media reporting and be adequately as well as decisively informed about this technology.

1.7 Research aim

The aim of this study is to critically explore the language or frames through which nuclear discourse is reported in the following South African print media: *Mail and Guardian* (M&G), *The Sunday Times*, *City Press* and *Witness*, and then interrogate the ideologies underlying the philosophies of these newspapers. The study will also compare and contrast the different perceptions and ways of narrating the nuclear discourse in these newspapers. The focus will be on the media reports just before and just after the Fukushima nuclear disaster. The trending on nuclear reporting will also be investigated and analysed to the current date, with respect to the Fukushima Daiichi nuclear accident.

1.8 Research questions

The research questions associated with the problem statement and research objective are as follows:

RQ1: How has the Fukushima Daiichi nuclear accident altered narratives about nuclear power technology in South Africa, taking into account the above CSF? In other words: Has the general tone of media coverage of nuclear energy in South Africa changed since the Fukushima nuclear disaster?

RQ2: Are there any new nuclear power narratives developing in South Africa following the Fukushima Daiichi accident? In other words: does the Fukushima Daiichi nuclear accident serves as a benchmark to report nuclear power technology in South Africa?

RQ3: Which type of sources or frames are being promoted or portrayed in the media? In other words: Has pro-nuclear framing of nuclear power in the media changed since the Fukushima disaster, or has anti-nuclear framing of nuclear power in the media changed following the Fukushima nuclear catastrophe?

RQ4: Which voices and narratives do the media represent on issues that can lead to policy change on nuclear energy in South Africa? In other words: are there any differences in media coverage between conservative and liberal media outlets with regard to nuclear policy change in South Africa?

Further practical questions that would be examined in this study through content analysis include:

(a) What is the tone of the passage in examined publications?
(b) Do certain frames exist for different standpoints or events?
(c) How are the main nuclear actors portrayed or characterised in the newspaper reports and articles?
(d) What types of metaphors are used and how are they linked to their reference frames?
(e) What types of words are repeatedly used to qualify arguments? For example, words such as ludicrous, irresponsible, nonsensical, and so on could be used to belittle arguments of opposing groups.
(f) How is scientific language presented by journalists – is it through quotes of experts, translated by journalists into laymen's terms, specific or vague, easy to understand? In addition, how is nuclear power presented generally?
(g) What is the main focus of the publications and what is deliberately included or omitted?
(h) How do passages fit into broader narratives of nuclear power debates?
(i) Are the sources used directly quoted in the media reporting or indirectly referenced?

These questions will be addressed as part of the research propositions and hypotheses below.

In order to address the main research questions above, and turn them into actionable statements, it is proposed that:

1. There is no relationship between the Fukushima Daiichi nuclear accident and the narratives about nuclear power in the South African print media.
2. The Fukushima Daiichi nuclear disaster did not ignite or introduce new trends in the reporting of nuclear activities in the South African print media.
3. The media discourse in South Africa has no preferred frames to report nuclear activities.

1.9 Research objectives

The objectives of this research work are three-fold:

1. To establish whether or not the Fukushima Daiichi nuclear accident has altered the narratives about nuclear power in the South African print media, with respect to the following factors (which are henceforth referred to as the Critical Success Factors (CSF): infrastructure developmental cost, affordability, proliferation, waste management, sabotage, terrorism, risks of nuclear disasters, nuclear policies, and public acceptance;
2. To investigate if new narratives and trends are developing following the aftermath of the Fukushima Daiichi nuclear disaster; and
3. To examine which types of sources are given a voice in the media, as well as how the media portray these source groups.

1.10 Research hypotheses

There are a number of complementary definitions of the term hypothesis in research literature. According to Leedy and Ormrod (2005:4; 270) a hypothesis is a “logical supposition, a reasonable guess, an educated conjecture” which provides a “tentative explanation for a phenomenon under investigation”. A hypothesis must therefore state the expected relationship between two or more variables and should be consistent with the existing body of documented knowledge. Further discussions on hypotheses will follow in Chapter 3.

The following hypotheses were formulated from the research objectives:

Hypothesis #1: The accident at Fukushima Daiichi Nuclear Power Plant did not have any bearing on the constructed image of nuclear power in the South African print media. It is assumed that the image of nuclear power remains unaltered and is independently built regardless of the focus given to nuclear accidents by the media.

Hypothesis #2: The accident at Fukushima Daiichi Nuclear Power Plant did not ignite a new public debate in the South African print media with respect to the use of nuclear power, thereby retaining a positive image about this technology.

Hypothesis #3: Media debates do not portray and promote a particular voice, stories or sources, with regard to nuclear energy policy change in South Africa.

In summary, the research problem statement and objectives can be outlined as shown in Figure 1.1.

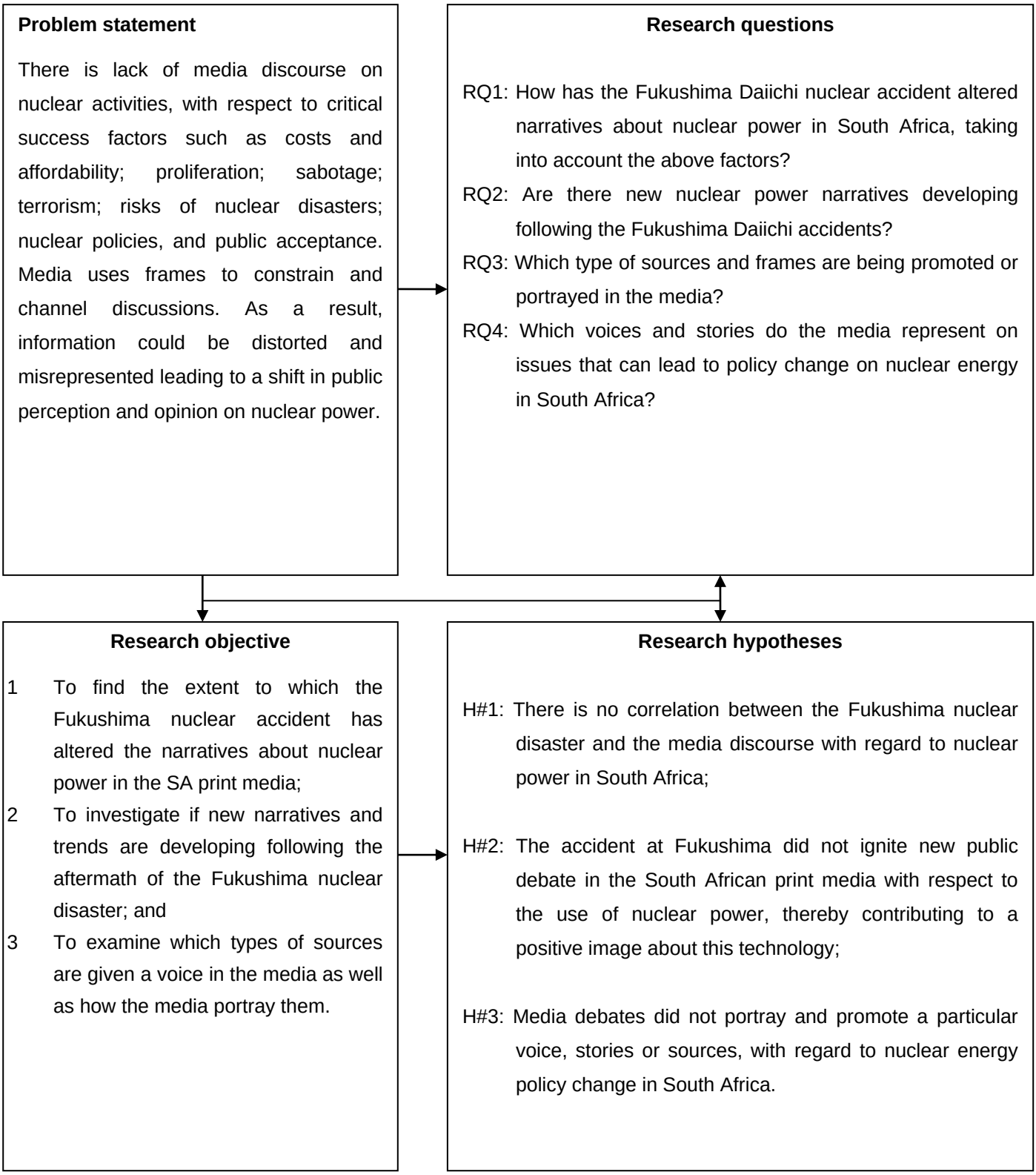

Figure 1.1: Summary of the research problem statement and research objectives

1.11 Conceptual research model

The conceptual research model, to be expanded in Chapter 3, can be summarised using the following framework:

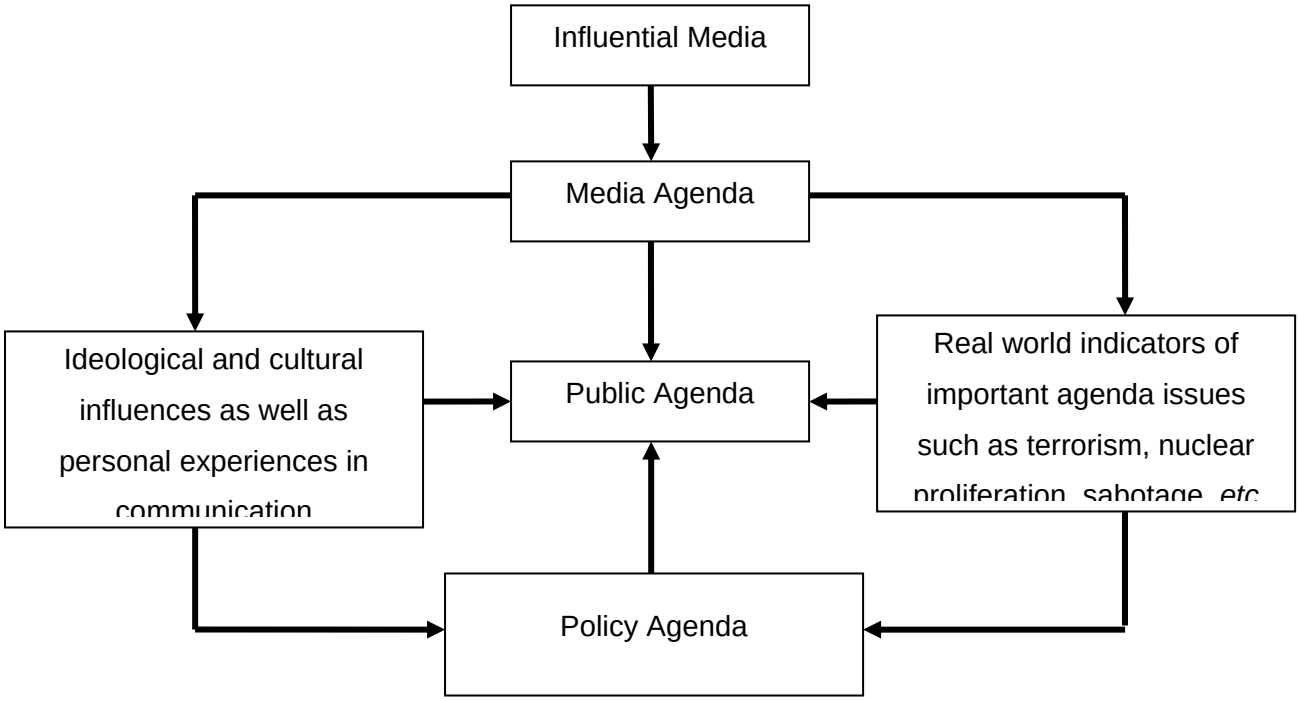

Figure 1.2: Conceptual model that will be used to analyse the media discourse about nuclear power in South Africa

The conceptual model may be explained in the following way: Influential media is made up of 'gate-keeping' entities that determine and set up the media agenda using progressive packages which support, promote and sustain a particular frame. Framing is seen as a critical activity in the construction of social reality since it helps fashion the perspectives, awareness and understanding through which the audience could see the world (Husselbee and Elliott, 2002:833-852; Hallahan, 1999: 205-242). The influential media uses ideological and cultural influences to direct the public agenda on areas of interest and to determine the nature of the discourse (Van Gorp, 2007:60-78). Public perception of critical factors such as terrorism, radioactive

nuclear proliferation, sabotage, health and safety, climate change, policy debates is influenced by the media agenda in their reportage. This conceptual model should serve as basis for the research objectives of this study.

1.12 Theoretical framework of study

This study makes use of the following four theories:

1. Frame theory;
2. Social Responsibility theory;
3. Language theories; and
4. Reception theories.

The above mentioned four theories will enable the researcher to critically investigate the language of reportage of nuclear power in South Africa in four selected newspapers: *Mail and Guardian*, *The Sunday Times*, The *Witness* and *City Press*. According to Husselbee and Elliott (2002:833-852), (see also references therein) framing is a form of communication that leads people to accept one meaning over another. Framing is a process by which the media attracts the public attention and responsiveness to selected topics through emphasis, and influences how people should think about the selected stories. In short, framing refers to the way in which the media and media gatekeepers organise, shape and disseminate stories, issues and events and how the audiences interpret, conceptualise and utilise the information that they are being provided with.

The importance of using framing theory in this study is that it helps in understanding the multiple ways in which journalists display moral and value judgements in the products that they create (Entman, 1993:51-58). Media products are human constructs that are mostly taken for granted by audiences. What journalists write reflects a dominant cultural order which imposes knowledge of social structures which are often taken for granted. Thus, far from being neutral observers, journalists come to their work with racial, gender, sexual orientation, class, geographic and generational identities that deeply affect not only what they select to cover, but also how they cover it (Gamson and Modigliani, 1989:1-37).

Social Responsibility theory will also be applied in this study. This theory emphasises press responsibility and accountability. It is based on the ethical principle that the media has the clear obligation to inform, educate and entertain the public in an impartial manner. According to reception theories, the media is expected to use unambiguous language in the dissemination of information that is truthful, accurate, objective, balanced and fair. The majority of people rely on newspapers to get information and often believe what newspapers report about (see Jewell, 2011:1041-1055, and references therein).

Different readers of a similar news frame, language or story could be seeing, interpreting or hearing this frame differently. They can actually come up with completely diverse or supplementary frames to explain that same story. It follows, therefore, that what readers see and hear is defined, informed by and usually resonates with their own class, gender or ethnicity. The assumption here is that people will in fact create their own meanings. Audiences are perceived as constructing meaning according to their individual needs, and this process is guided by culture and the context in which the message is received (Husselbee and Elliott, 2002:833-852).

In summary, the theories that inform the study have been outlined in this section. Their brief discussion justifies the approach and gives direction to the study as a whole. The next section looks at the methodology that was used to collect and analyse data.

1.13 Methodology

This study uses a qualitative or textual approach in its exploration of the language of reportage of nuclear power in South Africa. Interpretative packages, as described by Gamson and Modigliani (1989:1-37) have been used to perform content analysis. The frequency of issues or topics, messages and events presented in several types of media communications were profiled and evaluated as described by Macnamara (2005:4). Authoritative sources include the regulatory body (National Nuclear Regulator), governmental entities such the Department of Energy (DOE), and

industry officials. Comments of authoritative sources on nuclear power before and after the Fukushima accident were examined.

Qualitative approach has been chosen over quantitative approach since it is based on the notion that there is no objective 'reality' which can be observed and neutrally quantified (Wigston, 2009:5). This sentiment was underscored by Oshinowo, Jr (2004) who argued that media objectivity is always subject to bias, distortions and misrepresentations.

The themes to be examined in this study, as per media framing, include the following:

- Concerns related to maturity and implementation of nuclear regulations and requirements in South Africa;
- Costs associated with nuclear power commissioning and affordability;
- Problem of disposal of radioactive nuclear waste;
- Proliferation of nuclear material;
- Sabotage;
- Risks associated with catastrophic nuclear reactor accidents;
- Terrorism;
- Impact of Climate Change; and
- Emergency response to health and safety threats to the workers, local communities and environment due to the hazards of radioactivity.

The above themes will be mapped under stated hypotheses using the interpretative packages described by Gamson and Modigliani (1989:1-37), while also taking the PESTEL factors into account. The description of interpretative packages is given in Table 1.1:

Table 1.1: Descriptive overview of interpretative packages (Desai, 2002:6)

Package	Description
Progress	Frames nuclear power as an essential technology for economic growth and technological development.
Energy independence	Compares the use of nuclear power to other alternatives such as the energy renewable, e.g. solar, wind, bio-gas, *etc*..
Runaway	Frames nuclear power as essential and unavoidable energy production technology that the country cannot do without irrespective of nuclear disaster that might happen from its use.
Devil's Bargain	Contrasts runaway package in respect of the benefit that nuclear power can bring to the country.
Public Accountability	Evaluates the structural establishment of nuclear power production using mostly authoritative sources.
Cost effectiveness	Interrogates the cost associated with nuclear power expansions as compared to other energy producing technologies.
Soft paths	Interrogates the hazards associated with nuclear power, even when nuclear power is described under themes such as "atoms for peace", in relation to other energy generating technologies.

1.14 Expected contribution of study

The study may not directly contribute to the body of information on how the South African public perceive the use of nuclear power after the Fukushima disaster, but it is aimed at bringing some awareness to the profound impact that the media discourse can have in disseminating information to a receptive audience who mostly rely on newspaper reports to make informed decisions. It is hereby expected that the study will help to: (i) Characterise the Critical Success Factors (CSF) by their importance in nuclear debates; (ii) Increase the value of existing knowledge base; (iii) Evaluate future prospects of nuclear power in South Africa; and (iv) Highlight whether South Africans are pro-nuclear or are against its future development

1.15 Limitations and assumptions of the study

The limitations to the study, which will be considered in the analyses and conclusions are as follows: (i) The CSFs (listed in Section 1.6.1) selected for this research were not scientifically defined but were developed based on common global challenges being faced by nuclear organisations and nuclear power plant installations; (ii) The sample used in this study does not represent the general perception about nuclear power in South Africa since only four newspapers were selected for content analysis; The results of this research cannot be applied to other modes of media such as TV, blogs, radio, internet sources, etc.; (iii) The timescale to collect the data and to analyse feedback is limited and clearly defined; (iv) Most of the references or sources used for this study were produced around 2011, just prior to Fukushima nuclear disaster, and beyond 2011. Articles after 2012 are scantily referenced and are only examined for trending purposes.

1.16 Ethical requirements

Ethics Statement: this research does not deal with issues of human behaviour or animals, and as such, it does not require ethics clearance.

1.17 Scope and structure

The study is comprises of 7 chapters. Chapter 1 provides a general overview on media framing. The critical success factors (CSF) examined in four selected newspapers are briefly discussed. The research question and the research hypotheses are defined in chapter 1. Chapter 2 presents a critical review of the current literature on framing and media discourse on nuclear power. The conceptual framework and methodology used to perform content analysis on selected newspapers are discussed in Chapter 3. Research design, research strategy, data collection and data analysis are described in Chapter 4. Chapter 5 focuses on the research findings, while chapter 6 is devoted to the discussion of these findings. Conclusions and recommendations are presented in Chapter 7.

1.18 Conclusion

This chapter presented the background to the study, the statement of the problem, the research aim, objectives and research questions. A brief literature review was undertaken, coupled with the research methodology, scope of study, definition of terms and the layout of the research report. In terms of important details, this chapter has presented a general overview on how the media plays a role in setting the public agenda, which is used to direct the discourse on the subject of nuclear power technology. Some Critical Success Factors (CSF) are presented in order to examine media discourse with respect to Fukushima nuclear disaster.

The study aims to investigate how the media has analysed the CSF before and after the Fukushima nuclear accident, and to establish if there is a new trend developing with respect to the future use of nuclear power in South Africa. The study will therefore address the following questions:

RQ1: How has the Fukushima Daiichi nuclear accident altered narratives about nuclear power in South Africa, taking into account the above factors?

RQ2: Are there new nuclear power narratives developing following the Fukushima Daiichi nuclear accident?

RQ3: Which type of sources and frames are being promoted or portrayed in the media?

RQ4: Which voices and stories do the media represent on issues that can lead to policy change on nuclear energy in South Africa?

The next chapter presents a literature review on media framing and media discourse with particular focus placed on nuclear power. In summary, the research structure that is followed is shown in Figure 1.3.

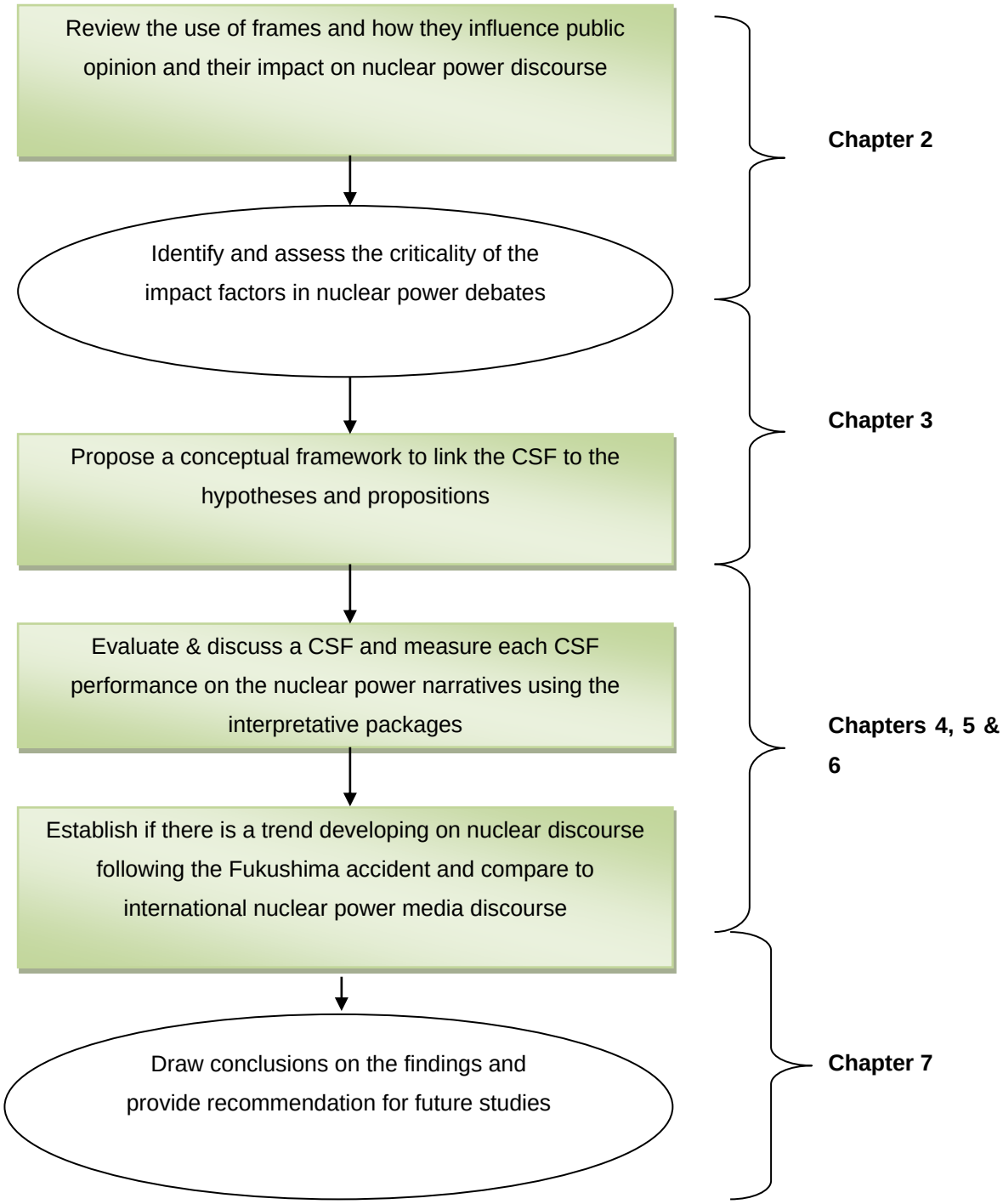

Figure 1.3 Research approach and overview of the chapters

CHAPTER 2

Literature review: media discourse on nuclear power

2.1 Introduction

The literature shows that prior to the Fukushima Daiichi Nuclear Plant disaster more than 50 countries had approached the International Atomic Energy Agency (IAEA) for support and technical know-how to build their first nuclear power plants (IAEA, 2009a; Rogner, 2009). However, the 2012 report by IAEA notes that the figure of countries interested in developing the new technology had declined to 29 (Dahl, 2012). IAEA has also noted in their report that:

> Among countries introducing nuclear power, interest remains high. Of the countries without nuclear power that, before the Fukushima Daiichi accident, had strongly indicated their intentions to proceed with nuclear power programmes, a few subsequently cancelled or revised their plans; others took a 'wait-and-see' approach, but most continued with their plans (IAEA, 2012:3).

With rising concerns about the effect of climate change and the security of energy supply throughout the world, most countries have shown interest in the renewable sources of energy (Netzer and Steinhilber, 2011). Some European countries have decided to abandon their intentions of using nuclear power to generate electricity but instead to increase the capacity for renewable energy generation (Dahl, 2012). This is in clear contrast to France, which has about 58 nuclear power reactors all in full operation, and is in the process of expanding their nuclear fleet. According to Godoy (2011:31-34) the French are never more than 180 miles away from a nuclear facility (Schweitzer, 2011:3). Such close proximity to nuclear reactors has not been correlated with increased fears and concerns. On the contrary, the French are proud of their technological sophistication, by which they see nuclear technologies as their heritage and national identity (Topcu, 2008).

In South Africa only two nuclear facilities are in operation. Koeberg Nuclear Power Station (KNPS) which is situated in the Western Cape, and the Safari research

reactor, located in Pelindaba, North West province. The Safari reactor is a research reactor that is used mainly to produce radioactive isotopes for medical purposes.

2.2 Aim of literature review

In this chapter, a critical evaluation and a comprehensive analysis of the current media discourse on nuclear power is presented. Most of the technical and authoritative publications on nuclear power have been provided by the International Atomic Energy Agency (IAEA), IAEA member states, interest groups and researchers. The information gathered through literature reviews will be synthesised by: (i) Comparing and contrasting various perspectives and opinions on the media debates on nuclear power, before and after the consequences of the Fukushima Daiichi nuclear disaster; (ii) Describing the recent trends in the use of nuclear power technologies; and (iii) Identifying general frames that the media tend to lean towards in their reporting of nuclear power technologies.

A gap analysis will be performed of the literature on the media debates about the state of nuclear power in South Africa in relation to other countries. Finally, a summary of the above theories will be presented to put this chapter in perspective, and to justify the conceptual models developed in Chapter 3. The study starts by first analysing the theoretical literature on media framing and its impact on debates.

2.3 Research on media frames

There is a large body of information on frame theory and framing, and on how framing has taken over from agenda-setting and cultivation theory as the most commonly applied research approach in most research fields (see Van Gorp, 2007: 60-78, and references therein). Media frames have also garnered substantial attention over the years, as reflected in the works of the following authors, Gamson and Modigliani (1989:1-37), Entman (1993:51-58), Dennis and Merrill (1996); and Fourie (2009, Volume 1-3). Media frames shape the ideological and cultural discourse and influence how the public perceives the importance of an issue through a variety of measures. For example, repetitive coverage of an issue by the media highlights the importance of an issue that is worthy of public attention (Ryan, 1991:18). Thus news frames guide authors in determining which details of a story to

pick out and emphasise and which details to omit or not emphasise. Fairhurst and Sarr (1996) summarise framing theory as a process by which:

> The media draws the public attention to certain topics; it decides what people think about. The journalists select the topics. This is the original agenda setting 'thought'….the way in which the news is brought, the frame in which the news is presented, is also a choice made by journalists. Thus, a frame refers to the way media and media gatekeepers organize and present the events and issues they cover, and the way audiences interpret what they are provided.

The weakness of framing research has been recognised, in regard to the identification and measurement of frames within a text structure. Various authors have pointed out that a frame is a rather theoretically abstract concept which is hard to identify "because frames consist of tacit rather than overt speculations" (D'Angelo, 2002:870-888; Entman, 1993:51-58 and Koenig, 2004:1-24). The empirical difficulties of frames affect the reliability and validity of various studies, and make framing research susceptible to subjectivity. Increased transparency and accountability on the part of the researcher are therefore required, on top of a systematic approach to measurement that would benefit visibility (Koenig, 2004:1-24; van Gorp, 2010:60-78).

Boycoff (2006:201–228), in line with the observations made by Koenig (2004:1-24), argued that news agencies have hegemonic control over the news that they publish and consequently they have tremendous power to shape and influence public debates. Boykoff (2006:201-228) stated further that the manner in which media outlets relay the news illustrates their bias. Thus, media outlets are not objective in their coverage of controversial public issues. Studies of media framing indicate that news coverage is biased in favour of official sources (e.g., government officials, scientists, news sponsors) because journalists believe that representatives of social movements lack credibility and knowledge to influence debates (Gamson and Modigliani, 1989:1-37; Rohlinger, 2002:479-507). As a result, social movement activists are often neglected or ignored by the media, thus creating barriers and obstacles for the transmission of activists' positions on controversial topics (See Rohlinger, 2002: 479-507, and references therein).

Several studies have emphasised bias and its role in the coverage of important issues and events (Rohlinger, 2002:479-507; Boykoff, 2006:201-222). McCarthy, McPhail and Smith, (1996:478-499) have identified several general types of selection

bias in the media: (i) news gathering routines; (ii) newsworthy pegs; (iii) corporate hegemony; and (iv) media issue attention cycles. According to McCarthy *et al* (1996:478-499) and later asserted by Parenti (2007), news gathering routines refer to the fact that journalists tend to report on issues when their access to the information is convenient and these news items are more likely to be broadcast in the media (Cottle, 2010:427-448). McCarthy *et al* (1996:478-499) further explain that events are newsworthy when they distinguish themselves by their uniqueness and broader appeal to the public.

Corporate hegemony refers to the news media's capacity to shape the news in order to please their sponsors or media gate keepers. Media issue attention cycles refer to the inconsistency of media consideration. That is, newspapers do not always focus on the same issues. This makes it difficult for certain events to be published. The last two concepts - corporate hegemony and media issue attention cycles - are central to this study because they directly concern the debate over nuclear energy in South Africa. As for-profit businesses, newspapers are dependent on sponsors. Because of this, newspapers are less likely to publish news arguments or ideas critical to current or potential corporate sponsors (Gamson and Modigliani, 1989:1-37), or news events that could also "threaten their own interests" (McCarthy, *et al*, 1996:478-499). Therefore, the perceived interests of the institutions that financially support newspapers shape how the news is presented to the public.

Interestingly, media studies have found that the State or other social movement opponents can strategically curtail the influence of social movement organisations using a variety of means. First, they can alter and align social movement frames to fit their own political and media goals (Rohlinger, 2006:537-561; Adams and Shriver, 2011:163-189). Second, they can co-opt social movement frames into their fold to confuse the passive and receptive public (Rohlinger, 2006:537-561). Third, social media organisations can isolate social movement organisations in order to draw away news coverage from the issues they raise (Rohlinger, 2006:537-561). Fourth, journalists can cover the two sides of a debate "in order to present the 'illusion' of fair and balanced coverage when in fact their coverage clearly favours official sources" (Schweitzer, 2011:10). Finally, government can ostensibly and subtly control the media (Schweitzer, 2011:10, Linden and Klandermans, 2006:213-228).

Given the power of State actors to influence media communication, social movement organisations often discover themselves at a decided disadvantage in terms of media framing. Social movements' frames are less prominent in the media because it is very challenging for them to exist in opposition to the official frames created by the media sponsors. To counter the predetermined disadvantage positions, some social movement organisations resort to:

> acting like other legitimate news sources, which includes issuing press releases, holding press conferences, and providing journalists with a steady stream of research and information about their issue, organizational activities, and goals (Rohlinger, 2006:538).

While it is possible for social movement organisations to challenge official frames through use of novelty, drama and 'counter-framing' (Benford and Hunt, 2003:161), it is exceedingly difficult given differential resources and media access available to these social movement organisations (See Rohlinger, 2006:537-561 and references therein).

Analysts have argued that it is important to understand how state agencies are active participants in shaping public debates because of their involvement in the process of constructing meaning and reality. Sometimes the sponsors resort to cohesion and threats in order to manipulate media coverage of public issues (Lazic and Kaigo, 213: 260-273). Ferree (2004:85-101) argues that excluding an actor from the debate (e.g., social movement activists) is a powerful tactic because it prevents the actors' narrative from resonating with current debates. Debates are thus constructed around official frames supported by general institutions, and oppositional frames supported by social movement organisations that have far less media coverage (Schweitzer, 2011:10; Rohlinger, 2006:537-561). Noakes (2000:657-680) has noted that:

> In terms of both material and cultural resources, State managers enjoy significant advantages over social movement entrepreneurs and the official frames they construct have a greater chance of triumphing in the struggle for cultural supremacy than do collective action frames mobilized by social movement entrepreneurs. But I also argue that there are limits to official frames (Noakes, 2000:673).

The next section considers the disputes of frame in the media and how they would impact the current study.

2.4 Disputes of frames in the media

It is widely recognised that the media does not have infinite space available for news coverage, and therefore journalists are limited by space constraints, deadlines and capacity to investigate every story selected for publication (Parenti, 2007). As a result, journalists and editors are forced to prioritise, screen and select the information they wish to disseminate (Entman, 1993:51-585). Frame disputes always arise in the media because journalists have to select which events or issues to cover and which ones to omit, based on the notion of resonance. Resonance refers to "the mutually affirming interaction of a frame with a discursive opportunity structure supportive of the terms of its argument" (Ferree, 2003:310). Resonance must "connect the collective action frame to cultural meanings and symbol systems of the [targeted] audience" Mueller (1992:15). Based on the above assertions, resonance is therefore a central point of contention in the conflict for the appearance – or the non-appearance – of narratives in the media (Gamson and Modigliani, 1989:1-37).

Previous studies have shown that framing contests, which are complex mechanisms, are important attributes of influence in media framing (See Coles 1998: 369-391). According to Ryan (1991:85), quoted in Schweitzer (2013:13): "At any time, a challenger may be using the media to reach one or more of five audiences: its active membership, inactive supporters; the general public which is unaware of the issue; a targeted foe; and media workers themselves, as a force worth organizing in its own right." This in effect means there would always be more than one school of thought with contrasting opinions aimed at the different types of audiences. To drive the message home, some competing social movement organisations can utilise framing to attack, destabilise and discredit their opponents, or completely ignore them, or they can absorb the opposing side's arguments in order to confuse the public with regard to the competing narratives. At best, the media activists can attempt to misrepresent and use stereotypes to mock opinions of their adversaries. All of these efforts are aimed at convincing and manipulating the audience to reject their opponents' frames (Benford and Hunt, 2003:153-186).

Framing contests continue to occupy centre stage as movement organisations and their media opponents strive to exert influence in the media and try to articulate their

respective frames. Past studies have illustrated the importance of counter-framing in these dynamic relationships (Benford and Hunt, 2003:153-186). Counter-framing is defined as “attempts to rebut, undermine, or neutralize” the frames of your opponents (Snow and Benford, 1988:626). Thus, frames are developed and utilised not only to win support for a particular position, but also to discredit the frames of opponents. This means frames can be linked to frame deployers. The next section investigates this argument on how frames and users can be linked.

2.5 Linking frames to users

The media debates and arguments put forth in the book, *Media debates: Issues in mass communication* by Dennis and Merrill (2006) clearly show that there is a significant gap in the literature regarding the link between media frames and frame deployers (i.e., those that are attributed with articulating particular frames) (Dennis and Merrill, 2006). It is of great importance to critically study and analyse the relationship between frames and deployers since it exposes the processes through which media actors design, construct, structure, and/or alter their narratives over time (Ferree and Merrill, 2000:454-462). By linking frames to deployers, studies can then show actors who get frequent citation in media, especially on controversial and standing issues. Examining how media outlets attribute arguments to specific actors would shed some light on the role of power and authority in the construction of arguments and meaning (Steensland, 2008:1027-1054).

There are two well distinguished types of media frame deployers: (a) official specialists and (b) outside sources (see Steensland, 2008:1027-1054). The official frame tends to be cited more by journalists as they are seen as credible, legitimate and representative of the truth (Rohlinger, 2006:537-561). Such reliance on official specialists may, according to Steensland (2008:1027-1054), stymie public debate and discourse. In other words, the voice of official specialists may be seen to set trends in most controversial and standing issues with regard to public debates.

This is one of the key areas that this research work will investigate on nuclear power discourse in South Africa. Since nuclear power debates fall under the scientific realm,

it is important to consider framing of the scientific debates in general. This scientific discourse is considered in the next section.

2.6 Framing Scientific Debates

The coverage of scientific debates always presents additional complexities to journalists, who have to interpret scientific jargon, technical details and present their stories in language commensurate with the audience's understanding (Gamson and Modigliani 1989:1-37). Without appropriate translation of technical details it would be impossible for the general public to grasp the issues that are at stake (Ho, Brossard and Scheufele, 2008:171-192). Nisbet (2009:5-6) points out that "Scientists and their organizations must also learn to focus on framing their messages in ways that engage specific audiences and that fit with the constraints of a diversity of media outlets." In so doing, scientists would help the audience to better define the problem. Likewise, social movement actors must be equally well versed in unpacking complicated scientific arguments and articulate them to resonate with the general understanding of members of the public.

Nuclear power is a highly specialised field with its own suite of jargon and technical details, and is managed by highly skilled experts. Since journalists are generalists by profession, they lack the language and context to communicate risks associated with nuclear accidents because they are detached from the systems within which such events could happen (Friedman, Gorney and Egolf, 1992:305-323). Friedman (2011:55-65) emphasises the need for synergy in the interpretation of nuclear events between different institutions: the media, the nuclear industry and the government. Framing the debate over nuclear power means providing sufficient information through a language, context and with a tone appropriate for the public to understand and be able to engage in the discourse. Friedman *et al* (1992:305-323) have pointed out that media frames associated with scientific debates, such as nuclear power, are likely to transform over time in order to remain relevant. This argument is further developed in the recent article by Friedman (2011:55-65) in which the author provides in-depth analysis of accidents at the Chernobyl, Three Mile Island and Fukushima Daiichi nuclear facilities.

2.7 Media coverage of nuclear accidents

There have been a number of nuclear accidents before, but amongst them, the three worst ones involved Three Mile Island (TMI), Chernobyl and Fukushima Daiichi. These nuclear disasters have received quite substantial media coverage (Friedman, 2011:55-65). There have been some similarities in the coverage of the above three nuclear accidents, even though they occurred at different times: TMI in 1979, Chernobyl in 1986 and Fukushima Daiichi in 2011. The two main similarities were that: (i) the nuclear disasters were covered by journalists in real time. The details and accuracy of information became clear as the accidents unfolded; (ii) all three nuclear accidents involved complex technical scenarios whereby engineers and government officials had a hard time explaining what had happened without using technical language; It was challenging to use terms journalists could understand and present to the wary public. Coupled to this, many journalists did not have technical background in nuclear technology or radiation to ask probing questions.

The next sections examine in depth the accidents at TMI, Chernobyl and Fukushima Daiichi.

2.8 Three Mile Island (TMI) coverage

The TMI accident was covered in some great detail in the report by Rubin *et al* (1979). The content analysis of Rubin *et al.* (1979) report is based on news organisations in the United States such as the ABC, NBC and CBS, the New York Times, the Washington Post, the Los Angeles Times, the Philadelphia Inquirer and the Harrisburg Evening News.

The high level findings from Rubin *et al.* (1979) report at TMI were as follows (i) The quality of information to be disseminated to the public in a potentially life-threatening situation was critical. Such information was pivotal in determining how members of the public needed to respond towards a potential accident scenario, especially when the unfolding situation could impair public's health and wellbeing. This information was found to be "abysmally inadequate" (Rubin *et al.* 1979:215); According to Rubin *et al.* (1979:210) "neither public information officials nor journalists served the public's 'right to know' in a manner that must be achieved in the event of future accidents";

(ii) The information disseminated by those in charge was aimed at protecting the nuclear industry, while journalists resorted to sensationalising issues in order to extract more information from authoritative sources; (iii) there was serious lack of communication between relevant stakeholders; (iv) language barrier was mostly evident from the start. Journalists were not prepared to cover nuclear incidents, as much as officials had not learned to provide technical information to an appropriate level of public understanding and acceptance. This is reflected during one of the interview sessions:

> It was an experience ... considering the technical questions I was being asked and the lack of understanding of my answers. It's difficult for an engineer to respond to a technical question with anything except a technical response. And I knew by the questions I was getting back that the press people just didn't understand what was going on, and I knew there was going to be a real problem about getting information out to the public (Rubin *et al.*, 1979:5).

The health and safety issues were not adequately addressed to allay fears of the local communities. In a related study, Stephens and Edison (1982:199-259) presented a summary on the coverage of health and safety issues during the TMI accident, based on the data obtained through content analysis by Rubin *et al.* (1979). Their work brought more light to the following issues: (a) status of the accident; (b) potential threat of radioactivity if not well contained; (c) dangers due to nuclear core meltdown; (d) radiation exposure; and (e) explosion due to a highly flammable hydrogen gas in the reactor. Stephens & Edison (1982:199-259) concluded that the reporting on the TMI accident was politically charged which influenced and clouded the media debates around this event.

2.9 Chernobyl coverage

The Chernobyl nuclear spectre received much wider media coverage than TMI, possibly due to the large potential disaster it represented, even though the media coverage of the accident was strongly controlled and restricted by the Russian government (Friedman, 2011:55-65). Friedman, Gorney and Egolf (1987:305-323) evaluated media coverage on radiation reporting based on press releases over two weeks in the five leading newspapers: New York Times, Washington Post, Philadelphia Inquirer, the Wall Street Journal, and Morning Call. The study was extended also to three major television networks: ABC, NBC, and CBS. Friedman,

Gorney and Egolf's (1987:305-323) studies were severely curtailed from the very onset. Firstly, the accident occurred in the Soviet Union (in Ukraine) but information used in their studies was obtained from USA media sources, where the latter had limited access to real time information on the disaster. Secondly, it was found that radiation and radioactivity were not simple topics to understand or write about. Friedman *et al* (1987:305-323) set out to find answers to the following questions: (a) how much explanation of radiation information was available to the public to make an informed decision about evacuation?; (b) how complete were the radiation readings presented by official sources?; (c) did the recommendations on radiation reporting, contained in Rubin *et al.*'s (1979) report receive due consideration in Chernobyl? In other words, did Chernobyl re-assess its operational activities based on some lessons learned from TMI? (d) Did journalists avoid sensationalising radiation risks in their coverage to influence public opinion?

According to Friedman *et al*, (1987:305-323) the radiation coverage "appeared acceptable" but there was not enough coverage both in what led up to the accident and the level of explanatory information required to help the public fathom the risks and dangers associated with nuclear radiation. However, in comparison to TMI, the radiation coverage of Chernobyl was significantly better, even though the information on radiation levels offered was infrequent, or at best vague; the standard of completeness in radiation reporting in Chernobyl was sporadically applied; the media did not provide much help, but played a role of allaying fears for public safety.

2.10 Fukushima Daiichi coverage

The Fukushima Daiichi nuclear catastrophe has received significant media coverage compared to both the TMI and Chernobyl nuclear accidents. The streaming of the accident events were not confined to the print media and TV coverage, but extended through to social platforms such as Twitter, Facebook, YouTube, etc. According to the Nuclear Agency body, OECD (2013:8), based on the experiences from the Three Mile Island and Chernobyl accidents, it would take many years to get a full analysis of the Fukushima Daiichi NPP accident. A summary of media coverage is provided in Chapter 6.

2.11 Comparing coverage of nuclear accidents

There were many conspicuous equivalents in the flow of information during TMI, Chernobyl and the Fukushima Daiichi nuclear accidents, ranging from the absence of emergency communications strategies to the measured concealment of information on radiation releases. Interestingly, information about the accident at TMI was made available by officials in greater quantity over a shorter time period and with fewer constraints than at Chernobyl. However, the breakdown of information to be understood by both the journalists and the public was poorly handled in the case of TMI. Rubin (1987:42-57) noted that:

> But even though officials at TMI offered more information than the Soviets, and even though the accidents were quite different in severity, duration, consequence, and accessibility, coverage of Chernobyl in the U.S. news media was in many ways a replay of TMI (Rubin, 1987:44).

Journalists complained about many of the same problems both at TMI and Chernobyl in gathering information and its dissemination, particularly to affected local communities, and to the general public at large. Officials had failed to prepare local communities for events of such magnitude in all three nuclear disasters. There was a serious lack of communication in all events, with communities relying on multiple sources of information for evacuation, spread of radioactivity and volume of radiation.

Hans Blix, head of the International Atomic Energy Agency during the Chernobyl accident, declared that: “the Soviet reporting was late, meagre, but possibly not untrue. The West’s reporting was fast, massive and often misleading. Can there be anything in between?” (Rubin,1987: 54). The media coverage regarding Fukushima was no different to a large extent (Friedman, 2011:55-65), which underscores the sentiments expressed by Rubin (1987:54) when he pointed out that “journalists are naturally suspicious of anything nuclear because of the secrecy surrounding the technology and the lack of candour all governments have shown in the face of accidents”. Friedman (2011:55-65) noticed that although the media did much better in reporting Fukushima compared to TMI and Chernobyl, nonetheless, there was a problem with “vetting experts”. Some “experts” were not qualified enough to talk about the causes of the Fukishima Daiichi accident and the radiation risks (Friedman, 2011: 64; See also Sandman, 2011).

2.12 Summary and relevance of literature review for this study

The study highlighted that frame resonance remains one of the critical issues for any study of framing (Noakes, 2000:657-680). For a frame to resonate with public expectation and common knowledge, it has to be available to the public. In other words, frames that are not promoted in the public arena cannot resonate with their targeted audiences. Differentials between social movement groups, government and industry officials often contribute to uneven coverage of particular frames.

The media framing process is crucial. The media not only screen and select which frames to portray to the public, but media agents are actively involved in the generation and deployment of frames (Entman, 1993:55-58). The media also determines which frames to include and which sources to cite. All of which makes media outlets exceedingly powerful in shaping public opinion and attitudes regarding ‘controversial’ public debates such as those around nuclear power.

The next chapter (chapter 3) analyses the extent to which media coverage of nuclear power in South Africa has changed following the Fukushima nuclear disaster. A qualitative approach was followed to analyse the data. The study was exploratory in nature as it attempted to address a number of open-ended questions such as: general tone used in the media coverage of nuclear power before and after the Fukushima Daiichi nuclear disaster. In particular, the research tried to find out how the tone of media coverage of nuclear energy in South Africa has changed since the Fukushima nuclear accident and if it did change, determine the extent to which it has changed. The study was extended to cover the prevalence of pro-nuclear and anti-nuclear articles on nuclear power after the Fukushima accident.

CHAPTER 3

Conceptual models for media reporting on nuclear power in SA

3.1 Introduction

In this chapter the research question is developed in order to make a stated research purpose more actionable, and to provide the necessary information to solve the given research problem (Cooper and Schindler 2003:54-55). A conceptual model, which links and integrates the applicable framing theories with the critical success factors mentioned in Chapter 1, is presented in this chapter.

A conceptual framework for this study was provided in Figure 1.2 and is again shown as Figure 3.1. The conceptual model will be consolidated in this section with more inputs.

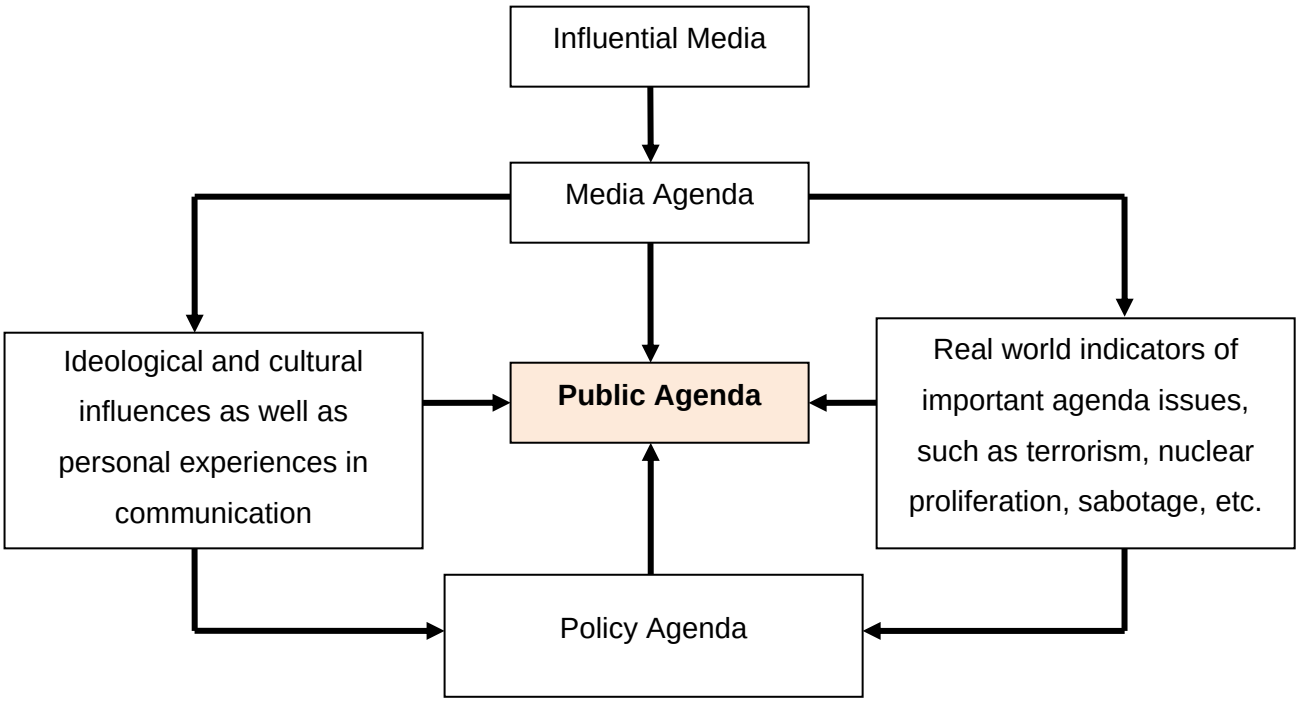

Figure 3.1: Conceptual model used to analyse the media discourse about nuclear power in South Africa

The Public Agenda discourse leads to further examination of key components in the conceptual model, as reflected in Figure 3.2.

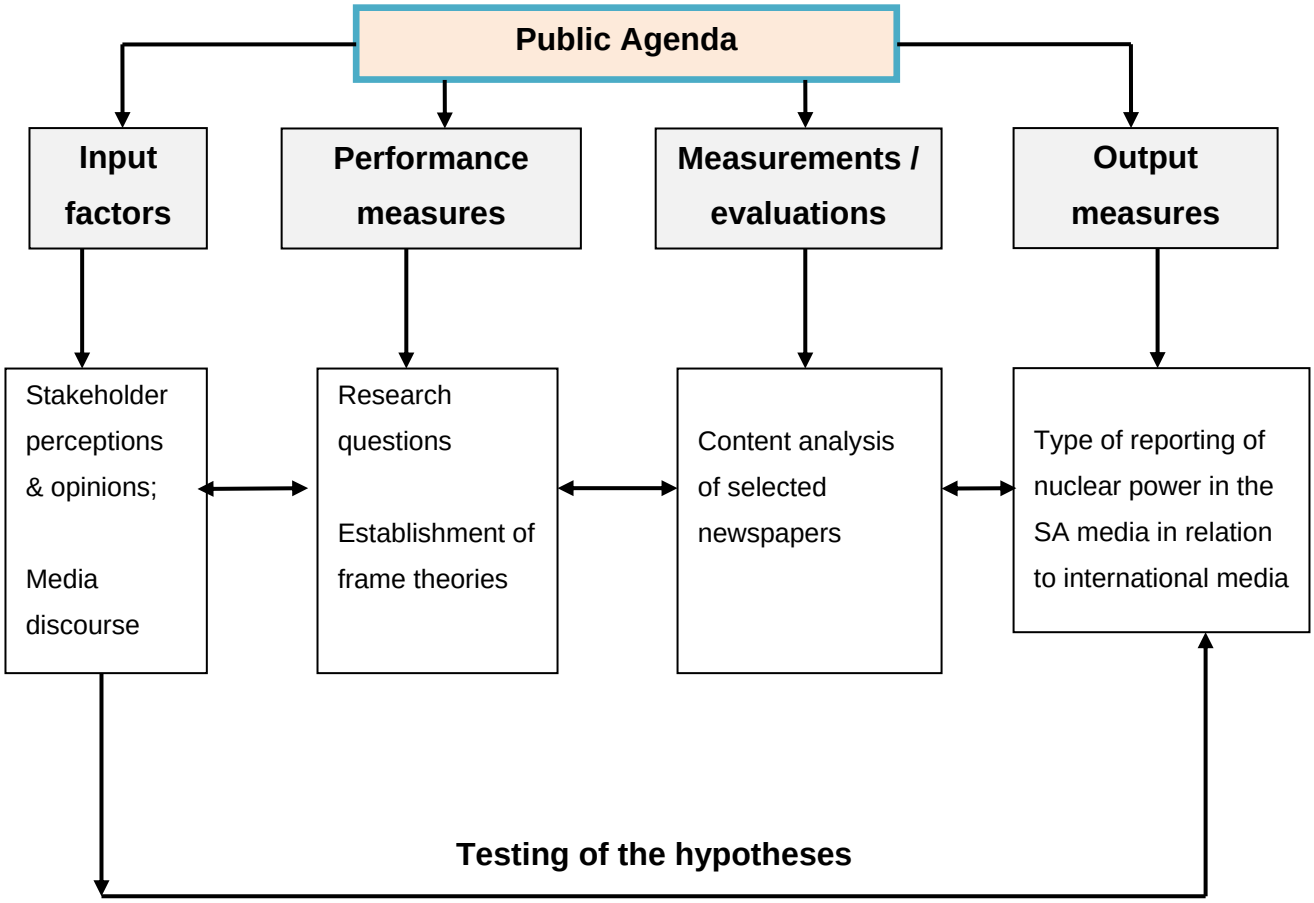

Figure 3.2: A conceptual model to investigate the relationship between Critical Success Factors (CSF) and the media discourse with relation to nuclear power in South Africa

To further develop our understanding of the above conceptual model, a brief description of a conceptual model and why it is used is presented in the next section.

3.2 Research model

According to Severin and Tankard (1988:17-30) models are used to visualise, discuss, and review a structure or process in a systematic way using simplified representations in graphic form. Cooper and Schindler **(**2003:55) assert that the role of a model is *representation*, while the role of a theory is *explanation* or description of

a phenomenon. Therefore, a model can be seen to be a representation of a particular theoretical explanation of a structure or process.

The basic functions of a model are to relate data with theory, to explain a complex theory in a simplified way, to predict the outcome or a certain course of events and to provide some measurements in a case of quantitative research (McQuail and Windahl, 1981:2). Cooper and Schindler (2003:55), give three major functions of a model, which are: descriptive, explicative and simulation. Descriptive modelling is used when there is a non-existent or inadequate theory available to describe a system or a process. Explicative modelling is used to provide some insight and enhance the researcher's understanding of key concepts of well- developed theories. Simulation is aimed at clarifying relations between concepts.

3.3 Input factors

The input factors contained in media discourse and coverage are made up of internal factors and external factors. These factors have been summarised in Chapter 1, and include: (i) Concerns related to maturity and implementation of nuclear regulations and requirements in South Africa; (ii) Costs associated with nuclear power commissioning and affordability; (iii) Problem of disposal of radioactive nuclear waste; (iv) Proliferation of nuclear material; (v) Sabotage; (vi) Risks associated with catastrophic nuclear reactor accidents; (vii) Terrorism; (viii) Impact of Climate Change; and (ix) Emergency response to health and safety of the workers, local communities and environment due to the hazards of radioactivity.

The flowchart used to extract information on the above input factors is given as Figure 3.3.

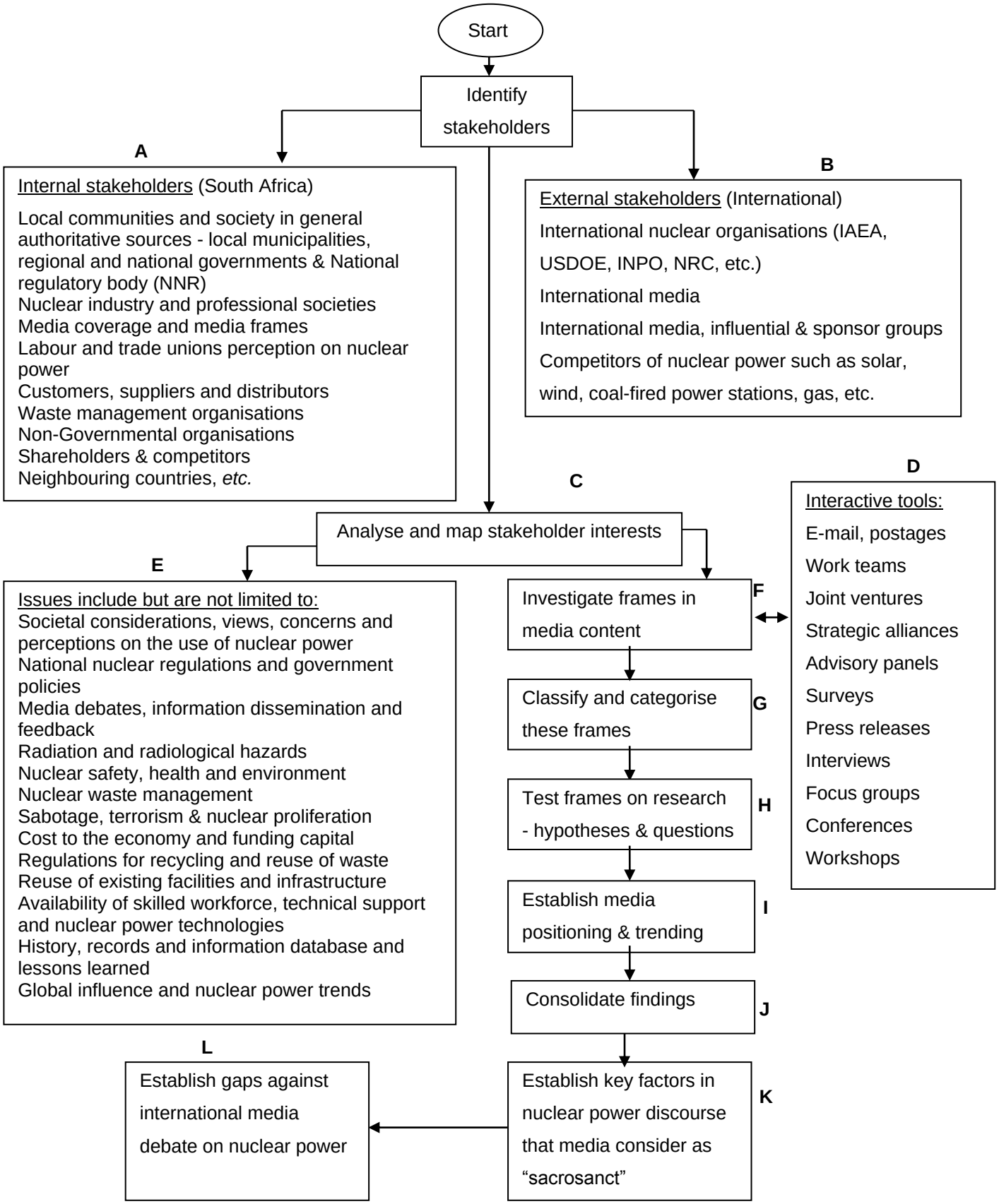

Figure 3.3: Identification of stakeholders and the methodology used to gather information

The components of Figure 3.3 are as follows:

A, B: The first important step in this study is to identify stakeholders. According to Hollaran (1995) research is not developed and is not carried out in a social/political vacuum. Many factors - economic, political, cultural and disciplinary impinge on research which produces a version of reality. It is for this reason that stakeholders need to be determined first. **A** lists most of the internal (national) stakeholders, while **B** lists external (international) stakeholders. The term "*stakeholder*" is used in the context as proposed by Duncan (2001:767), as the "…individuals or groups who can affect, or be affected, by an organisation". All stakeholders are interdependent in that their actions, or lack thereof, could have consequences on other stakeholders (Ehlers, 2002:155). A summary of the stakeholders is shown in the coding sheet attached as Appendix B.

C: The stakeholder concerns were collated and analysed for patterns, characterisation, and for prioritisation in the media coverage.

D: The interactive media tools to successfully engage all the stakeholders are listed. The list is not exhaustive. These communication tools can be used to solicit input, evaluate stakeholder views and perceptions, and to provide output (Gronstedt, 1996:156). The tools are also used to develop and implement media frames on controversial and standing issues on nuclear power.

E: Issues that will be examined through qualitative content analysis in the preselected newspapers.

F: Investigate and study the operational frames in the study. According to Semetko and Valkenburg (2000:95) media wants to attract the attention of audiences in an environment of multiple stimuli mainly to trigger the emotional response of readers.

G: Categorise these frames and evaluate their impact on the stories of interest.

H: Test the research hypotheses, propositions and the research questions on the identified frames.

I: Establish trending on nuclear power reporting as to whether it is leaning towards a pro-nuclear, neutral or anti-nuclear position. And establish the key issues of contention in media discourse on nuclear power.

J: Consolidate finding through quantitative analysis over a small limited sample where necessary to validate the results

K: The key determinant factors in nuclear power discourse will be profiled by priority from this study.

L: Establish whether gaps exist on nuclear power issues by comparing international reporting to South African reporting on the same subject, with particular focus placed on reporting just before the Fukushima Daiichi nuclear disaster and aftermath.

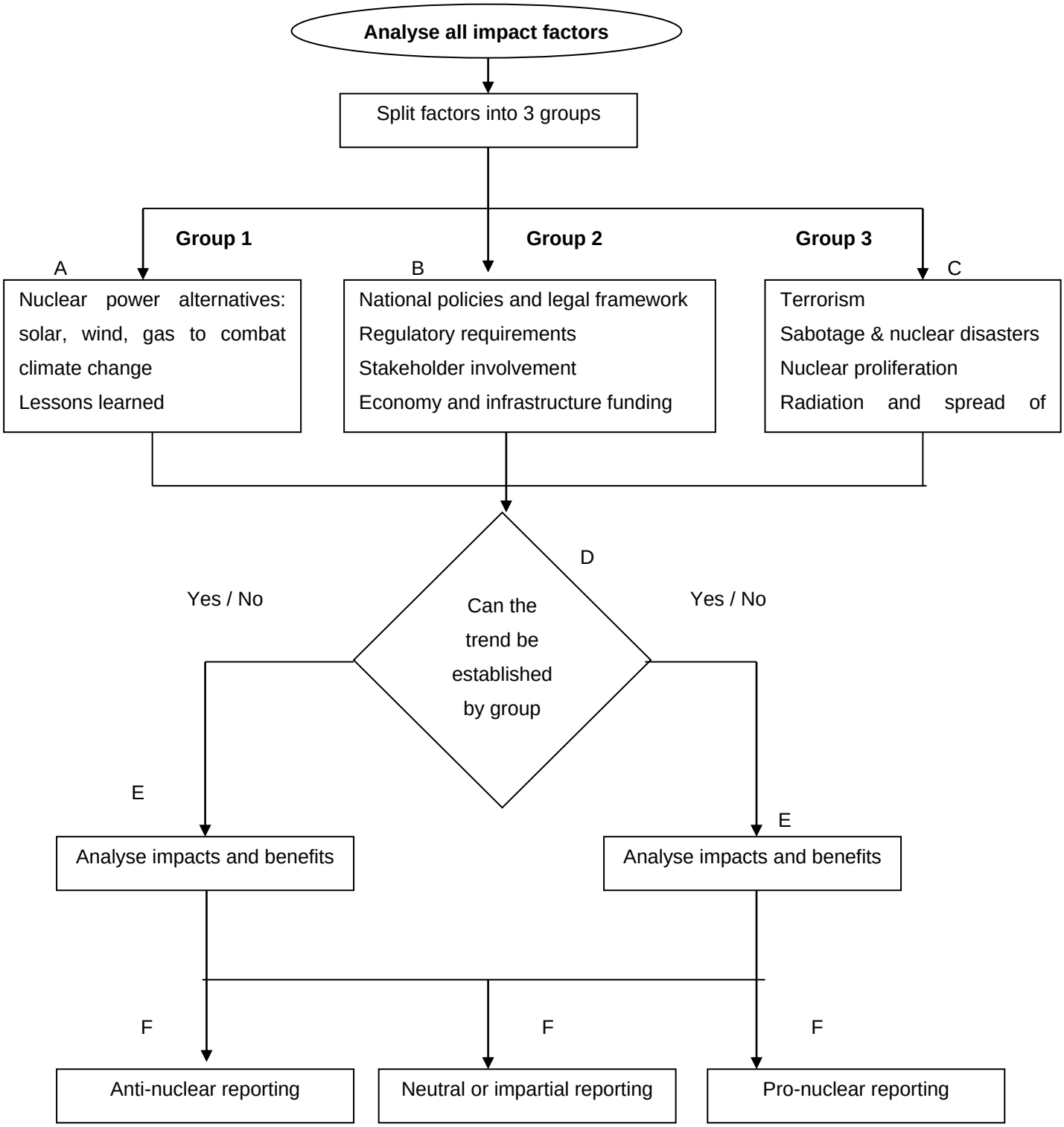

Figure 3.4: Research model used to characterise the impact factors in an effort to understand media framing theory

Figure 3.4 is described as follows:

For simplicity, identified factors which may have an impact on nuclear power discourse in South Africa have been placed in three groups due to their inter-relations and dependences. These groups can be seen as an interpretative media package.

A: Group 1 factors focus on alternatives to nuclear power. The proponents of these alternatives are anti-nuclear power. This has become commonplace in media coverage, especially in Europe (Blackmore, 2013:44-87; Friedman, 2011:55-65).

B: Group 2 factors are largely influenced by authoritative sources, influential groups and international media sponsors, as well as national stakeholder participation and relations. They are usually ranked second to Group 1 factors (IAEA, 2008a:20-26). The consequences, under the PESTEL framework, are political, societal, environmental and legal.

C: Group 3 factors involve extreme neglect in the use of nuclear power. They are ranked least in comparison to the other two groups in nuclear industry due to strict procedures, passive protective safety designs and active human intervention input. The consequences linked to these groups fall under economy, since the consequences, though remote, would be significant for the country economically.

D: Which media debates play critical roles in leading and promoting particular frames in order to be receptive to the audience? The research questions and the hypotheses presented in Chapter 1 will be tested here for specific output.

E: The impacts and benefit arising from the above step will be profiled from media content analysis.

F: Based on the content analysis and emergence of particular nuclear trends, a decision on SA's position, with regard to the commissioning of nuclear power, will be established.

3.4 Conclusion

In this chapter an integrated conceptual model was developed based on applicable theories discussed in Chapter 2. The aim is to establish a link between the research questions and the research propositions, with an effort to provide some answers to the research problem. Particular emphasis was put on the development of the media frame model for the nuclear industry.

Chapter 4 presents the research methodology that has been followed to address the research problem stated in Chapter 1. A qualitative approach has been used to collect and critically analyse media discourse for frames from four national newspapers, *viz*.: *Mail and Guardian (M&G), The Witness, City Press, and The Sunday Times (ST)* newspapers.

CHAPTER 4

Research design and methodology

4.1 Introduction

According to Social (2009), “a research design is used to structure the research and show how all of the major parts of the research project - the samples or groups, measures, treatments or programs, and methods of assignment - work together to try to address the central research questions”. Research design includes the following research aspects: design strategy, data collection design, sampling design, questions and the testing of measuring instruments (Botha, 2007:143). Cooper and Schindler (2001:135) provide a summary of key issues that should be considered when a research process is planned.

Building on the information presented in Chapter 3, this chapter focuses on outlining the methodology and methods that were employed for testing the conceptual framework, the research questions and the hypotheses presented in this study. High level considerations of elements contained in the research methodology, such as research design and research process, are illustrated in this chapter. Also contained in this chapter is the information on the population and the sampling used for the research, data collection, data analysis, as well as the process that was followed in compiling this research report.

According to Cooper and Schindler (2001:771), and underscored by Mouton (2001:49), research entails a structured and planned approach to the collection of data, analyses and interpretation of information in order to give acceptable answers to the research problem or questions. It therefore follows that a clear research methodology (process) needs to be established in order to investigate whether the aims of the study can be adequately met (Yin, 1994:18). Failing to identify an appropriate research methodology that will support the aims of the study could potentially put the research project in jeopardy. The study discusses the research design first.

The study employs qualitative content analysis to determine and detect the presence of framing on nuclear power reporting in South Africa before and after the Fukushima Daiichi nuclear disaster. Regarding data analysis, there are two possible approaches to perform content analysis of the news — inductive and deductive approaches (Semetko and Valkenburg, 2000:93-109). In this study a deductive approach is followed for framing analysis. Deductive reasoning is a process based on the premise that when conclusive statements are true or correct, then information extracted from the conclusions should also be correct (Johnson, 1996: 291). Accordingly, the deductive studies demand beforehand a clear idea of the frame likely to be encountered in this study. There might be other frames present in the text which only an inductive study could show. Conclusions derived from inductive reasoning may not necessarily be correct unless inductive study is particularly inclined towards specific events (Bisanz, Bisanz and Korpan, 1994:179-213). Koenig (2004) also warns against the highly subjective nature of inductive studies, and emphasises their marginal contribution to framing research.

According to Semetko and Valkenburg (2000:93-109) inductive studies are very difficult to replicate since they are based on relatively small samples. This is consistent with argument presented by Macnamara (2005:9) who further emphasised that an inductive approach should be avoided as it “allows issues, topics and messages to be added to the list of those tracked at the whim of the researcher, and those added during a study may have been present from the outset but not observed, leading to inaccuracies in data”.

The frame matrix applied in this study is informed by theories listed in Chapter 1, which are: (i) Frame theory; (ii) Social Responsibility theory; (iii) Language theories; and (iv) Reception theories. The frame matrix used is taken from article by Semetko and Valkenburg (2000: 100). This frame matrix uses five popular and influential generic frames: attribution of responsibility, human interest, conflict, morality, economic consequences. The frame matrix can be more easily compared across media sources, media types or over a given period of time, and can be put into operation as clusters of elements in order to shed more light on the presence of each frame in the study as well as to measure these frames (Semetko and Valkenburg, 2000:93-109). The frame matrix is shown in Table 4.1 and will be used as a guide

together with a coding sheet (Appendix B) to answering research questions presented in chapter 1.

Incorporating the frame matrix presented above to Gamson and Modigliani (1989:1-37), an episodic or issue specific frame can be constructed - the “nuclear energy policy metaframe”, which is presented in next section. First, the frame matrix of Semetko and Valkenburg is discussed (2000:93-109) as it applies to this research study.

4.1.1 Attribution of responsibility frame cluster

The attribution of responsibility frame cluster always assigns an issue or problem and its course “to the government, an individual or a group” (Semetko and Valkenburg, 2000: 96). Such a step is crucial to the exercise of civic control. It is intrinsically linked to who is responsible or what or how is to be blamed for the specific problem.

4.1.2 Human interest frame cluster

Media always want to attract the attention of audiences in an environment of multiple stimuli mainly to trigger the emotional response of readers. According to Semetko and Valkenburg (2000:95), “this frame brings a human face or an emotional angle to the presentation of an event, issue or problem,” accounting also for personalisation, dramatisation, sensationalisation of issues in the story (An and Gower, 2009:107-112). Giannakopoulos (2013:30) also pointed out that “journalists attempt to find the human face of science and risk when it comes to nuclear accident reporting, where technical jargon is generally viewed with great suspicion and frowned upon”.

4.1.3 Conflict frame cluster

The conflict frame cluster emphasises conflict “between individuals, or institutions as a means of capturing audience interest” (Semetko & Valkenburg, 2000:95) since media draw from central common frames to report issues or problems. Conflict and blame are the two key criteria of risk, as observed by Kitzinger (1999:55-69), who also argues that media interest is “stimulated by overt conflict between stakeholders

perceived government vested interests and secrecy" (Kitzinger, 2009:63), thus emphasising political undertones in the application of this frame. This study is interested in establishing common frames, comparing and evaluating conflict frames when nuclear power is reported in South Africa print media, with particular emphasis placed on timelines around the Fukushima Daiichi nuclear disaster.

Table 4.1: Frame matrix taken from Semetko and Valkenburg (2000: 100)

A-**I. Attribution of Responsibility Frame Cluster** Does the story suggest that some level of government has the ability to alleviate the problem? Does the story suggest that some level of the government is responsible for the issue/problem? Does the story suggest solution(s) to the problem/issue? Does the story suggest that an individual or group is responsible for the issue/problem? Does the story suggest the problem requires urgent action?
A-II. Human Interest Frame Cluster Does the story provide a human example or "human face" on the issue? Does the story employ adjectives or personal vignettes that generate feelings of outrage, empathy caring, sympathy or compassion? Does the story emphasize how individuals and groups are affected by the issue/problem? Does the story go into the personal or private lives of the actors? Does the story contain visual information that might generate feelings of outrage, empathy-caring, sympathy or compassion?
A-III. Conflict Frame Cluster Does the story reflect disagreement between parties/individuals-groups-countries? Does one party-individual-group-county criticize another? Does the story refer to two sides or to more than two sides of the problem or issue?
A-IV. Morality Frame Cluster Does the story contain any moral message? Does the story make reference to morality, God and other religious tenets? Does the story offer specific social prescriptions about how to behave?
A-V. Economic Consequences Frame Cluster Is there a mention of financial losses or gains now or in the future? Is there a mention of the cost/degree of expense involved? Is there a reference to economic consequences of pursuing or not pursuing a course of action?
B. Episodic or Issue-specific Frame
I. Nuclear Energy Policy Metaframe
B-I. Nuclear Energy Policy: Pro-nuclear Frame Cluster Does the story suggest economic or environmental benefits of nuclear energy? Does the story suggest key stakeholder support for nuclear energy?

Is there a reference to a need for energy efficiency or a need for energy mix? Is there a mention of a correlation between nuclear energy and the demand for cheap electricity? Does the story make reference to the reliability of nuclear energy?
B-II. Neutral Nuclear Energy Policy Frame Cluster Does the story suggest a balance in the pros and cons of nuclear energy? Does the story suggest a fatalistic necessity or inevitability of nuclear energy ('runaway')? Is there a mention of an ambivalent position on nuclear energy, i.e. a Faustian devil's bargain? Is there a reference to 'trade-off' between nuclear energy and climate change?
B-III Nuclear Energy Policy: Anti-nuclear Frame Cluster Does the story suggest economic or environmental risks of nuclear energy? (0.20) Is there a reference to health or safety risks of nuclear energy? Does the story make reference to a need for alternative energy? Does the story refer to the disposal of nuclear waste? Is there a reference to the proliferation of nuclear weapons?

4.1.4 Morality frame cluster

According to Semetko & Valkenburg (2000:96) morality frame "puts the event, problem or issue in the context of religious tenets or moral prescriptions". Journalists tend to refer to popular community moral sentiments or central organising ideas to support a particular issue or to highlight a problem (Odijk, Burscher, Vliegenthart, and Maarten de Rijke, 2013). Such common sentiments reside in the minds of the audience but may not be in the news at times.

4.1.5 Economic frame cluster

Commonly used in the news, the economic frame cluster focuses on the magnitude of economic downturn on an "individual, group, institution, region or country" due to nuclear accidents (Semetko & Valkenburg, 2000:96). Nuclear accidents, as events of severity, have sweeping consequences that relate directly to the economic status of a country, institution or group. This consequence is clearly pointed out by Blackmore, (2013:44-87) following Germany's recent decision to abandon nuclear power following the Fukushima Daiichi accident.

4.1.6 Nuclear energy policy framework

Political aspects of national energy policy are embedded in the reporting on a nuclear accident. Nuclear disaster is a crisis of unparalleled prominence and always demands government intervention, as shown in TMI, Chernobyl and Fukushima Daiichi. On more than one occasion, as observed by Kitzinger (1999:61), the media coverage "reflects not the 'objective hazard' but the indicators of social and political activity around those issues". Thus, the existence of such a media frame is acknowledged.

The nuclear energy framework brings together conflicting, and at times competing, frames. The nature of politics demands subtle choices to be made between competing interpretative value packages, even when they are in clear conflict (Borah, 2011:246-263). The components of the three frames in the nuclear energy framework would relate to pro-nuclear, neutral and anti-nuclear positions.

4.2 Overall tone of media reporting regarding nuclear power

The overall tone of nuclear power media coverage was examined from the positions of pro-nuclear, neutral and anti-nuclear, including viewpoints from the international community, South African national nuclear framework and the International Atomic Energy Agency (IAEA). This was done in order to identify gaps and to establish lessons to be learned. The assessment is based on global attitude measures adapted from Bruken's MA dissertation (2006:34,35), which used nine descriptors to determine attitude of the audience. For this research the five descriptors presented in Table 4.2 will be used.

Descriptors best represent the criteria upon which they were coded for this study.

1. Obscure/Explanatory-Informative: Obscuring the flow of information in relation to the nuclear accident, or acting as an explanatory/informative hub of information were attributes often mentioned in the content. The media was scrutinised for 'withholding information', or being 'informative', and offering adequate information to members of the public. Assigning the value of 'neutral' caters for the coding of absence or non-occurrence.

2. Fast/slow: Measures the response rate of international media, selected national news media and the IAEA to issues at hand.
3. Efficient/Inefficient: This attribute is characterised by the dissemination of information in a timely manner (Brunken, 2006:35) Reporting such as “there is widespread public perception that Japan hasn’t issued timely and complete information since the outbreak of the nuclear disaster” (Magnier, Lee and Roan, 2011) from the *Los Angeles Times* fits more adequately in the first pair.
4. Prepared/Unprepared: This pair of opposite meanings is quite apparent and it relates directly to the assessing of preparedness of each public body.
5. Unreliable/reliable: this last pair, in the fashion of Brunken (2006) assesses the local, central government and the IAEA’s consistency, dependability and trustworthiness. It relates to descriptions of the activities of these public bodies as a whole, rather than their performance in specific areas, e.g. information flows (see pair no.1), or response rate (see pair no. 2).

Table 4.2: Overall attitude tones to nuclear technology after the Fukushima accident

1. **Overall tone: International media on nuclear power**
    1. 1) Obscure ----- (2) Neutral ----- 3) Explanatory/Informative
    2. 1) Slow ----- 2) Neutral ----- 3) Fast
    3. 1) Inefficient ----- 2) Neutral ----- 3) Efficient
    4. 1) Unprepared ----- 2) Neutral ----- 3) Prepared
    5. 1) Unreliable ----- 2) Neutral ----- 3) Reliable

2. **Overall tone: South African nuclear media on nuclear power**
    1. 1) Obscure ----- (2) Neutral ----- 3) Explanatory/Informative
    2. 1) Slow ----- 2) Neutral ----- 3) Fast
    3. 1) Inefficient ----- 2) Neutral ----- 3) Efficient
    4. 1) Unprepared ----- 2) Neutral ----- 3) Prepared
    5. 1) Unreliable ----- 2) Neutral ----- 3) Reliable

3. **Overall tone: International Atomic Energy Agency (IAEA)**
    1. 1) Obscure ----- (2) Neutral ----- 3) Explanatory/Informative
    2. 1) Slow ----- 2) Neutral ----- 3) Fast
    3. 1) Inefficient ----- 2) Neutral ----- 3) Efficient
    4. 1) Unprepared ----- 2) Neutral ----- 3) Prepared
    5. 1) Unreliable ----- 2) Neutral ----- 3) Reliable

Using the information presented in Chapter 1 and 2, the research methodology is now presented in the next section.

4.3 Research methodology

4.3.1 Content analysis and its application

The study examined, through qualitative content analysis, how media project and reflect social, cultural and political issues, values and phenomena (Hansen, 2005). A great deal of literature on content analysis is available but the notion of its objectivity has been much criticised over the years, leading often to the accusation that this method is equivalent to ‘counting for the sake of counting’ (Hansen, 2005; Wimmer & Dominick, 2011). Nonetheless, the qualitative content analysis was the main process used to examine media reporting on nuclear power in South Africa. The following questions were examined in this study.

4.3.2 Research questions

The research questions associated with the problem statement are as follows:

RQ1: How has the Fukushima Daiichi nuclear accident altered narratives about nuclear power in South Africa, taking into account the above factors? In other words: *Has the general tone of media coverage of nuclear energy in South Africa changed since the Fukushima nuclear disaster*?

RQ2: Are there any new nuclear power narratives developing following the Fukushima Daiichi accident?

RQ3: Which types of sources or frames are being promoted or portrayed in the media? In other words: *Has pro-nuclear framing of nuclear power in the media changed since the Fukushima disaster, or has anti-nuclear framing of nuclear power in the media changed following the Fukushima nuclear catastrophe?*

RQ4: Which voices and narratives do the media represent on issues that can lead to policy change on nuclear energy in South Africa? In other words: *are there any differences in media coverage between conservative and liberal media outlets pertaining to nuclear policy change in South Africa?*

Further practical questions that would be probed using content analysis, include:

(a) What is the tone of the passage in examined publications?
(b) Do certain frames for diverse viewpoints or events ever exist?
(c) How are the main actors portrayed or characterised in the newspaper reports and articles?
(d) What types of metaphors are used and how are they linked to their reference frames?
(e) What images and symbols are portrayed or invoked in the reporting?
(f) What type of dictation is used with regard to repeated use of words, connotations of words and modification of the subject words with adjectives?
(g) How is scientific language presented by journalists – is it through quotes of experts, translated by journalists into laypeople's terms, specific or vague, easy to understand, and how is nuclear power presented?
(h) What is the focus of the publications and what is deliberately included or omitted?
(i) How do passages fit into broader narratives of nuclear power debates?
(j) Are the sources used directly quoted or indirectly referenced?

The next section looks at research hypotheses presented in Chapter 1, to put this research in perspective.

4.3.3 Hypothesis

Table 4.3 presents some definitions of the term "hypothesis" by a number of authors to highlight the interdependence and/or relationship between variables under study.

Table 4.3 Definitions of a hypothesis (Prasad, *et al.* 2001; Sharma and Battina, 2001)

Author	Definition
Ary, Jacobs and Razavieh, 1984	A hypothesis may be precisely defined as a tentative proposition suggested as a solution to a problem or as an explanation of some phenomenon.
Kerlinger, 1956	A hypothesis is a conjectural statement of the relation between two or more variables.
Creswell, 1994	Hypothesis is a formal statement that presents the expected relationship between an independent and dependent variable.
Ary, Jacobs and Razavieh, 1984	Hypothesis relates theory to observation and observation to theory.
Kerlinger, 1956	Hypotheses are relational propositions.
Lind *et al.* (2005:317)	A statement about a population parameter developed for the purpose of testing.

4.3.4 Testing a hypothesis

According to Lind, *et al* (2005:318) testing a hypothesis is "a procedure based on sample evidence and on probability theory to determine whether the hypothesis is a reasonable statement". Testing of a hypothesis always refers to a so-called a "statistical hypothesis", which is usually a null hypothesis. Leedy and Ormrod (2005:55) postulate that a null hypothesis (H0) is a propositional statement that reflects no differences between groups, no relationship between variables, no patterns in data to be tested, and states the opposite of what the researcher would expect or predict.

An alternative hypothesis or research hypothesis (H1) "is a complement of the null hypothesis, that is, it postulates some difference or inequality" (Diamantopoulos and Schlegelmilch (2000:132). H1 "is a statement that is accepted if the sample data provide sufficient evidence that the null hypothesis is false" (Lind, *et al* 2005:319).

The following hypotheses were formulated from the research objectives:

4.3.5 Hypotheses used in this study

Hypothesis #1: The accident at Fukushima Daiichi Nuclear Power Plant did not have any effect on the constructed image of nuclear power in the South African print media. In other words, it is assumed that the image of nuclear power remains unaltered and is independently built regardless of the focus given to nuclear accidents by the media;

Hypothesis # 2: The accident at Fukushima Daiichi Nuclear Power Plant did not ignite new public debate in the South African print media with respect to the use of nuclear power, thereby contributing to a positive image about this technology.

Hypothesis #3: Media debates do not portray or promote a particular voice, stories or sources, with regard to nuclear energy policy change in South Africa.

These hypotheses are broken into the null and research hypotheses for investigation as shown in Table 4.4, which are tested at face value as propositions.

Table 4.4: Research objectives linked to propositions

Research objective	Label	Propositions	Frame Matrix
To establish whether or not the Fukushima Daiichi nuclear accident has altered the narratives about nuclear power in the South African print media	P0	The Fukushima Daiichi nuclear accident did not alter nuclear debates in South Africa print media	Table 4.1 section A-I; A-II; A-III; A-V; B-I; B-II; B-III
	P1	The Fukushima Daiichi nuclear accident triggered serious nuclear debates in South Africa print media	
To investigate if new narratives and trends are developing following the aftermath of the Fukushima Daiichi nuclear disaster	P0	There are no trends developing concerning nuclear discussion in the SA print media after the Fukushima Daiichi nuclear accident	Table 4.1 section A-I; A-II; A-III; BI; B-II; B-II
	P1	There is an emergence of trend setting in the SA print media after the Fukushima Daiichi nuclear accident	
To examine which types of sources are given voice to in the media as well as how the media portrays these source groups.	P0	There is no preferred source / voice in the SA print media on nuclear position after the Fukushima nuclear accident	Table 4.1 section A-I; A-II; A-III; BI; B-II; B-II
	P1	There is a strong preference for a particular source / voice in the SA print media on nuclear power position	

4.4 Methodology employed in the current research

Media reports that have words ‘Fukushima’ and ‘nuclear accident’ were collated, classified and categorised by the degree of importance for this study. To determine which actors were most cited in the four newspapers under review, the number of direct and indirect quotes, credited to different sources within newspaper articles, was counted. The sources were grouped into the following categories: industry officials, government officials, professional and independent nuclear experts, nuclear regulatory agencies, private citizens, activists who are pro-nuclear and those against it, workers in nuclear industry, business professionals, and miscellaneous. The coding method used to extract information is presented in depth in Chapter 5.

4.5 The scope of research

Following the discussion on the research design in the above section, the scope of research is modelled through an illustration in Figure 4.1.

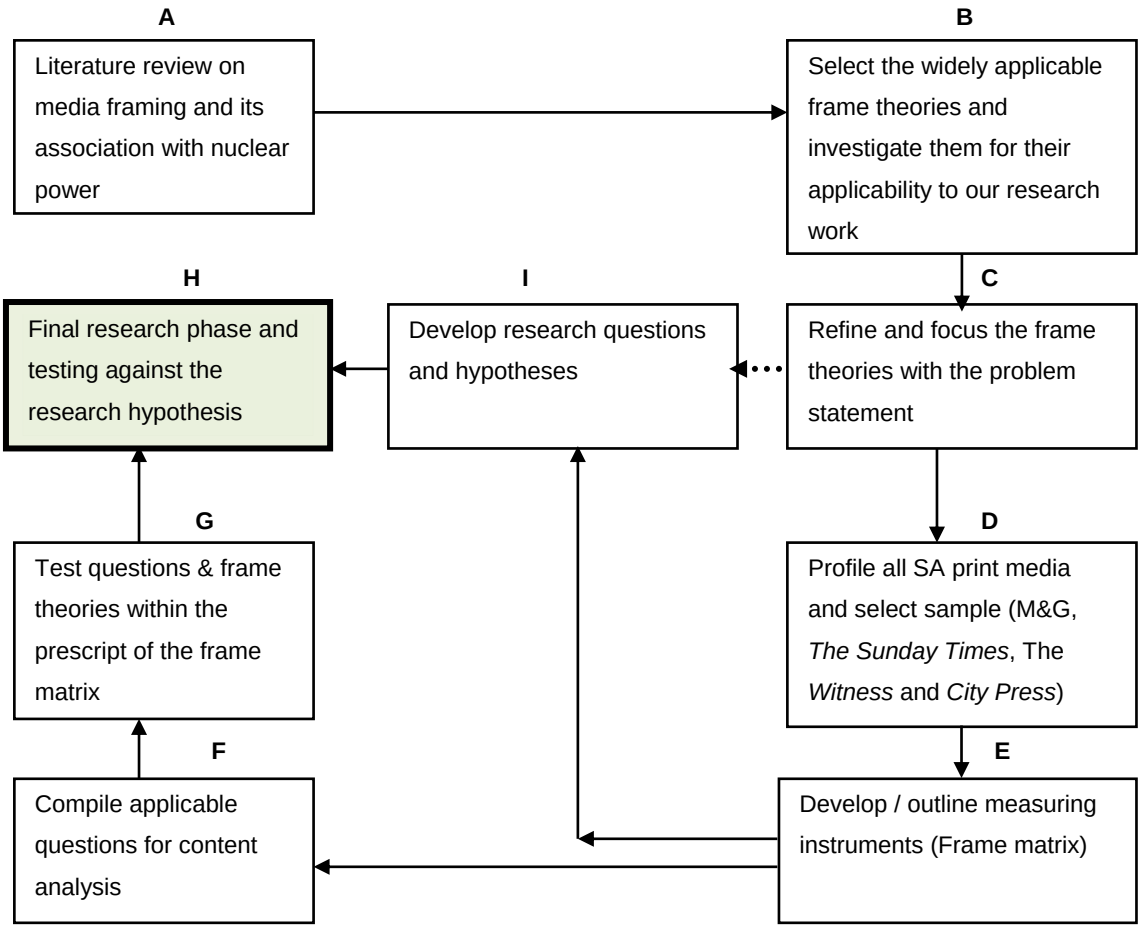

Figure 4.1: Scope of research process followed in this study (adapted from van Heerden, 2001:217)

Figure 4.1 is briefly discussed as follows:

A: The theoretical basis for this study is derived mainly from literature review and analysis.

B: References on media framing have been compiled extensively for applicability in nuclear industry.

C: Reduce the frame theories and consolidate the research approach.

D: Select four newspapers from majority list based on their independence, impartiality, information and credibility to their audience.

E: Use the frame matrix to construct measuring instruments.

F: Review and update the research questions; hypotheses to be within the scope of the frame matrix.

G: Test the research questions in line with the frame matrix.

H, I: Test the hypotheses after final content analysis of collected information including international standards and benchmark.

4.6 Population and sampling

A population refers to a group or collection of items with a particular characteristic that the researcher desires to understand, to make some inferences and draw some meaningful conclusions from. The elements in a population can refer to groups, organisations, human products and events, or the conditions to which they are exposed (Botha, 2007:149).

Sampling involves elements within a population or unit of analysis within the entire (full) population. The usual goal of sampling is to produce a representative set of elements that is similar to the population on all characteristics, except that it involves fewer elements. The discussions of various sampling methods are now common-place (Cooper and Schindler, 2001:166), but it suffices to say that a purposeful random sample was used for this study.

For our study the identified population comes from all South Africa print media, but the sample is made up of four key newspapers- *Mail and Guardian, Witness, City Press* and *The Sunday Times.* For conceptualisation purposes, it would have been ideal to have analysed all newspapers but for practical purposes, it was decided that it would be too costly, time consuming and impractical. In the case of this study, it is postulated that the selected sample is more likely to produce reliable results than the polling of the entire population which has, in any case, a limited knowledge on the subject of nuclear power (Struwig and Stead, 2001:107).

The four sampled but diverse newspapers are each briefly discussed to bring focus into this research.

4.6.1 *Mail and Guardian* newspaper

The *Mail & Guardian (M&G)* was established in 1985 after the closure of two liberal newspapers - the *Rand Daily Mail* and *Sunday Express,* to maintain a tradition of critical journalism in an increasingly untenable political landscape prevalent in South Africa then. The newspaper was summarily closed after three years of operation and its leadership incarcerated by the South African apartheid regime. *M&G* resurfaced in early 1995 following the conglomeration of few newspapers with in-depth journalistic

reporting. Today the newspaper enjoys a weekly readership of over five hundred thousand and remains as one of the most credible newspapers for its impartiality, independence, in-depth reporting and well-researched articles.

4.6.2 *City Press* newspaper

City Press is a Sunday newspaper aimed at a middle class black professional readership and mainly serves as the political conscience of the African majority in South Africa. This newspaper is not only distributed nationally, but reaches neighbouring countries, such as Botswana, Lesotho, Namibia and Swaziland. It has a readership of about 2.5 million a year. *City Press* has progressively shifted to the left quite recently by consciously taking a critical stance against the current South African government, especially in exposing corrupt dealings by government officials.

4.6.3 *The Sunday Times* newspaper

The Sunday Times (ST) is one of the most read and remains a popular conservative South African Sunday newspaper. It has a weekly readership of over 3.2 million, inevitably defining it as the largest weekly produced newspaper in South Africa. The newspaper was founded in 1906 and is accessible throughout the world.

4.6.4 *Witness* newspaper

The *Witness* (previously known as *The Natal Witness*) was established in 1846 to serve mainly the readership in Pietermaritzburg, Durban and the inland areas of KwaZulu-Natal (KZN). The *Witness* newspaper harbours both conservative and liberal viewpoints. It boasts of a relatively low but loyal readership in KZN and is now available via other platforms such as electronic media.

4.7 Data collection

The data collection process involves determining the data sources, defining the population, deciding on the sample and establishing the method and approach to be followed to collect data and the means or instruments that will be used (Botha, 2007:147). There are two forms that constitute the sources of data: The primary source of data and the secondary source of data. According to Cooper and Schindler

(2001:260) primary data is unprocessed or raw data made up of memorandums, letters, speeches, laws, regulations, and so on. Primary data can be both qualitative (not quantified but can be expressed in words, pictures, drawings, etc.) and quantitative (*i.e*. data can be presented in numbers). Secondary source data imply that the data had value added to it through analyses and interpretation. Secondary source data therefore represents textbooks, academic publications, handbooks, and so on (see Cooper and Schindler 2001:260).

Qualitative research normally involves the three main methods for collecting data: participant observation, interviews, and reviews of documents and records (Mertens and McLaughlin, 1995:50; Struwig and Stead, 2001:13; Sogunro, 2002; Kvale, 2007). Each piece of data collected has a reason and purpose to support the goal of the research project. Other methods such as witnessing, surveillance, interviews and inspection (Mouton 2001:105), were not used for this study. Quantitative research method is an inquiry into an identified problem, based on testing a theory, measured with numbers, and analysed using statistical techniques. The goal of quantitative method is to determine whether predictive generalisations of a theory can hold true in all situations of interest (Kvale, 1996:59).

4.8 Validity and reliability of study

The research quality and credibility of the study can be assessed by means of different measures in terms of validity and reliability (Blumberg *et al*, 2005; Peter, 1979; Struwig and Stead, 2001:141-143). In this study, validity measurement would remain difficult since only the qualitative approach is followed. Furthermore, a degree of ‘subjectivity’ might be introduced by the researcher in the study. Content validity is reflected through a clear correspondence between the data collected (from a selected sample used) and the theoretical media framing models discussed in Chapter 2.

Reliability is concerned with the extent to which the research may be replicated in a consistent way to produce the same results (Yin, 2003). From the gap analysis and international benchmark results, it would become evident whether this study is reliable. Reliability will be discussed further in chapter 6.

4.9 Conclusion

This chapter outlined the methodology that was followed to complete the research study. The research phases of the study were described including the research design, research scope, population and sampling, data collection and data analysis. A brief description about newspapers to be examined in this study is also provided.

The next chapter focuses on the research findings. The information will be categorised and analysed with reference to the supporting and applicable literature.

CHAPTER 5

Results

5.1 Introduction

This chapter presents the results obtained from the four newspapers that were examined for this study. However, a major part of the results comes from content analysis of the two mainstream newspapers – *Mail and Guardian (M&G)* and *The Sunday Times (ST). M&G* has adopted a somewhat liberal approach in its reporting, whereas *ST* tends to follow a conservative and conventional approach. More than 156 articles (see Appendix A) from four newspapers used in the study were analysed for this study. Table B.1 (Appendix B) shows the coding sheet used for extracting information for this study. Newspaper articles that were analysed were first grouped and profiled according to pre- and post- Fukushima Daiichi nuclear accident.

5.2 Presentation of the results

Table 5.1 shows the frequencies and percentages of the distribution of the articles before and after Fukushima Daiichi accident, between 11 March 2010 and 11 March 2012. The examined articles were limited to a year before and a year after the nuclear accident. It is envisaged that this approach would assist in determining the overall tone of the media discourse on nuclear power. However, most nuclear power articles analysed in this study were published after 2012. The research was therefore extended to include these articles for purposes of investigating trending of prominent nuclear themes, as well as establishing the extent to which framing is used in the South African media coverage of nuclear technology.

It is interesting to note that none of the articles examined in the *Witness* newspaper for the time period, 11 March 2010 – 11 March 2011, make reference to nuclear power in South Africa. Most of the articles report on the Iran nuclear expansion programme and the position taken by the permanent United Nations nuclear states, (calling themselves P5+1 – China, France, Russia, United Kingdom and United States and Germany) against Iran. Just one article (3%) in *City Press* has some relevance to the study. Most of the newspaper articles before the Fukushima Daiichi

accident take a neutral view about nuclear technology, focusing on issues such as nuclear expansion programmes in the world, maintenance, shutdown of the nuclear facilities for upgrades and so on.

Table 5.1: Frequencies and percentages of the distribution of all nuclear power articles analysed before and after Fukushima, between the years 11 March 2010 and 11 March 2012 and between 12 March 2011 and11 April 2015

Date	***Witness***		***City Press***		***The Sunday Times***		***Mail and Guardian***	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
11 March 2010 – 11March 2011	0	0	1	3	4	9	3	6
12 March 2011 – 11March 2012	12	44	12	35	31	72	33	63
12 March 2012 - date	15	56	21	62	8	19	16	31
Totals	**27**	**100**	**34**	**100**	**43**	**100**	**52**	**100**

Table 5.2 shows the rate at which authoritative sources were quoted directly and indirectly in the articles published a year before the Fukushima Daiichi accident and the current date. Out of 52 articles in *Sunday Times* (*ST*), government officials were consulted in about 77% of the publications. This means that more than ¾ of the articles published in the *M&G* newspaper make reference to government officials (official frame). The statements quoted by reporters in *M&G* newspaper, either directly or indirectly, are a factor of 1.6 more than those published in *The Sunday Times* and factor of 2.5 more than those reported in the *City Press*.

A closer look at the data in Table 5.2 indicates that the National Nuclear Regulator (NNR) and Necsa, are the least quoted or consulted groups on the subject of nuclear technology, even though the NNR is charged with regulating nuclear activities in South Africa, while Necsa is responsible for nuclear research and development (R&D). Interestingly, Niasa, which has been solely established to promote nuclear technology, is the least consulted organisation. Surprisingly, private citizens appear to be a preferred voice in nuclear discourse over combined efforts of organisations

established to map, lead and direct nuclear discussions in South Africa. In Chapter 6, we will discuss whether ignoring crucial role players (Necsa, Eskom, NNR and Niasa) in nuclear power discourse can be linked to media framing or not.

Table 5.2: Frequencies of authoritative sources quoted directly and indirectly in all nuclear articles that were analysed. The articles collected were published between 11 March 2010 and 15 April 2015.

Elements	*Sunday Times*	*City Press*	*Witness*	*Mail and Guardian*	**Total**
Government politician & designation	40	45	15	111	**211**
Eskom (including Koeberg Nuclear Power Station)	8	1	0	4	**13**
Necsa	0	2	0	4	**6**
PBMR	1	0	0	0	**1**
NNR	1	0	0	5	**6**
Private citizen	8	0	0	23	**31**
Academic / Professional / Specialist / Expert /Consultant	17	4	15	40	**76**
Business community / nuclear industry	5	0	2	8	**15**
Niasa	2	1	0	0	**3**
Nuclear worker (including labour union member)	1	0	0	6	**7**
Number of direct quotes/ citation by all nuclear activists	99	49	29	216	**364**
Number of indirect quotes/ citation by all nuclear activists	89	44	21	140	**273**
International organisations / Other	26	6	14	48	**94**
Total number of articles from each newspaper	43	34	27	52	**156**

Figure 5.1 offers a visual representation of the data given in Table 5.1.

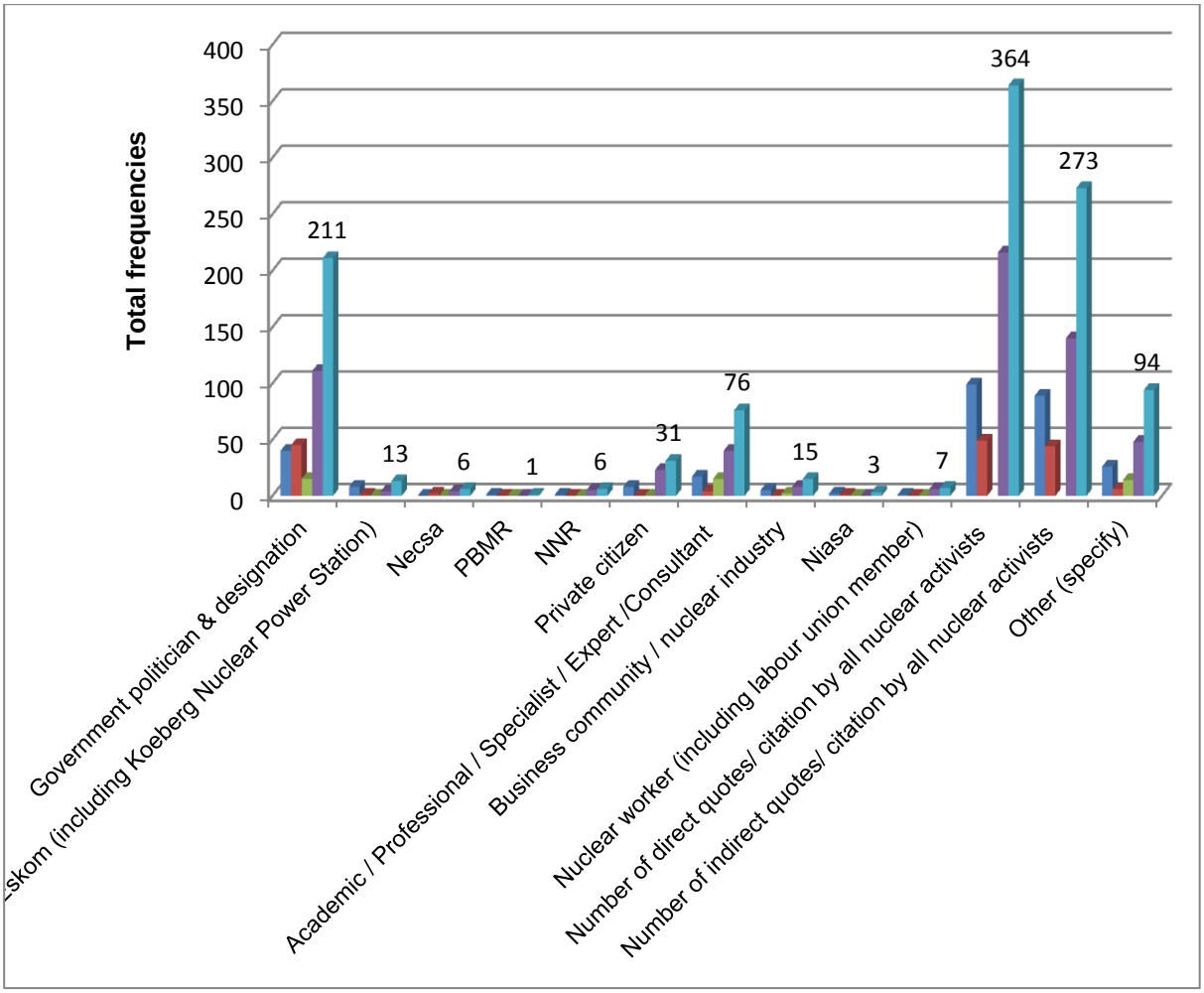

Figure 5.1: A summary of all nuclear activists tracked in all articles on nuclear analysed on nuclear technology including indirect quotes used in the articles.

Table 5.3 shows all the nuclear debates and discussions reported in the selected newspapers. The aim of Table 5.3 is to establish the general nuclear themes usually reported in newspaper articles. From the data, 23 of the articles are pro-nuclear, 29 are anti-nuclear; 71 of the articles take a 'neutral' view, while 35 of articles provide a balanced account in nuclear power reporting.

By pitting *M&G* against *ST* newspapers, it appears that at least double the articles published in *ST* support nuclear technology in South Africa and elsewhere outright. However, this sentiment is overshadowed by 'neutral' articles, which account for over a third of all the newspaper reports. The so-called neutral articles, as stated before, generally provide facts or information about the nuclear industry, such as new

developments, evaluation of costs to repair or maintain the nuclear plants, appointments of senior staff, and so on, neither promoting nor condemning the use of nuclear power. The anti-nuclear themes stand out strongly in the *Witness* newspaper, accruing up to 41% of articles as compared to a collective average of 20% from the other three newspapers. It should also be noted that relatively few articles were procured from the *Witness* newspaper as compared to other three newspapers. The statistical distribution of the result might change if fewer articles from *M&G* or *ST* were to be used.

Table 5.3: Frequencies of percentage distribution of all nuclear technology discourse before and after the Fukushima Daiichi accident. The examined articles were published between 11 March 2010 and 15 April 2015.

Newspapers	**Pro-nuclear themes**		**Anti-nuclear themes**		**Neutral**		**Both pro- and anti-nuclear themes**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
The Sunday Times	8	35	5	17	24	34	8	23
Witness	2	17.5	12	41	7	10	4	11
City Press	7	30	6	21	12	17	9	26
Mail and Guardian	4	17.5	6	21	28	39	14	40
Total	21	100	29	100	71	100	35	100

The data in Table 5.3 shows that there is some degree of correlation between the pro-nuclear themes and the anti - nuclear themes with a calculated chi-square of 4.537 which is less than the critical chi-square value of 7.815 (at $p < 0.05$). The discussion for the chi-square is provided in Chapter 6.

The data reported in Table 5.4 show that there no relationship (Chi-square = 16.569 > 7.815, at $p<0.05$) between the tone of the articles and the period during which these articles have been published. Before the Fukushima Daiichi accident, 40 % of

articles were pro-nuclear and 40% of articles generally adopted a balanced view about nuclear power technology. Only 10 % were characterised as neutral.

Table 5.4: Frequencies and percentages of the distribution of all nuclear power articles before and after Fukushima, between the years 11 March 2010 and11 March 2012

Item	Before Fukushima accident		After Fukushima accident	
	Frequency	Percentage	Frequency	Percentage
Pro-nuclear articles	4	40	5	6
Anti-nuclear articles	1	10	9	10
Neutral	1	10	53	60
Articles with both pro and anti-nuclear positions	4	40	20	24
Total	10	100	88	100

Notes: Data represents the total newspaper articles coded (N=98). Data comes from the following sources: *M&G, Witness, City Press and The Sunday Times.* Chi-square=16.569, at $p<0.05$.

As shown in Table 5.4, there appears to be no difference in the anti-nuclear articles published before and after the nuclear accident in Fukushima Daiichi. Interestingly, articles taking a neutral view on nuclear technology have shot up from 10 % to a massive 60% after the accident. The pro-nuclear articles took a serious knock after the accident, dropping from 40% down to only 6%. This could be indicative of the drop in the confidence levels that people had in nuclear technology.

In summary, it appears that the media coverage of nuclear power, which had been mainly positive before the catastrophe (40%), has shifted toward a more neutral coverage of the debate (53%).

A pictorial representation of the data captured in Figure 5.2 shows a comparison of pro-nuclear and anti-nuclear groups for the two time ranges: from 11 March 2010 to 11 March 2011 and 12 March 2011 to 11 March 2012. That is a year before the accident and a year after the nuclear accident at Fukushima Daiichi. For the *Witness*

newspaper, there were no pro-nuclear articles published before the accident and only one article was published after the accident. Two articles appeared in the *M&G* prior to the accident and none afterwards. The *ST* has seen zero articles before, and three after the accident, respectively. For the entire time span of 11 March 2010 to 11 March 2012, only two articles were published in the *City Press* - one article prior to the accident and one after. In summary, there was no massive surge of articles that supported or criticised nuclear technology directly in all four newspapers. The impact of lack of pro-nuclear and strong anti-nuclear positions is discussed in chapter 6.

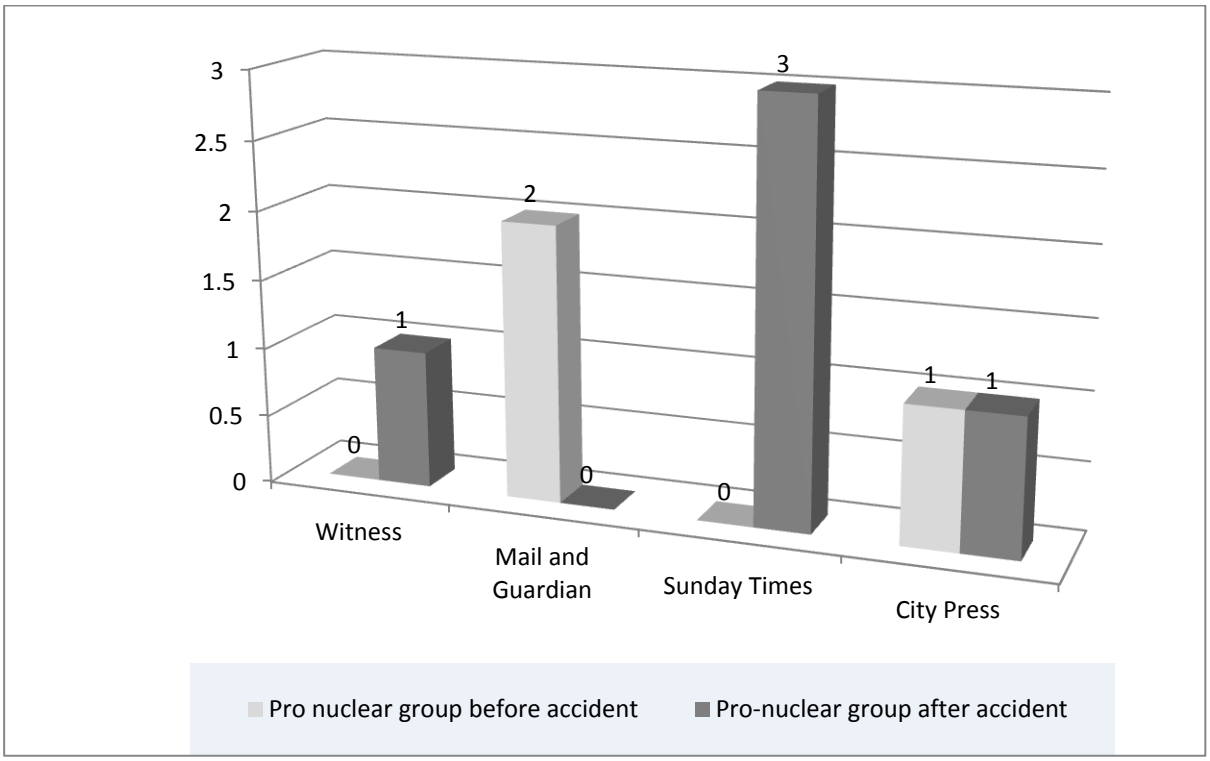

Figure 5.2: A comparison of the pro-nuclear themes reported in media prior to and after the Fukushima Daiichi accident. The data is for a year before the accident and a year after the accident.

Figure 5.3 shows anti-nuclear themes before and after the Fukushima Daiichi nuclear accident. The three newspapers, *Witness, Mail and Guardian* and *City Press* had no strong anti-nuclear articles published a year prior to the accident. The total number of articles published in the *Witness* reached seven a year after the accident. *The Sunday Times* published five anti-nuclear articles. Only two articles apiece appeared in the *Mail and Guardian* and the *City Press* a year after the accident

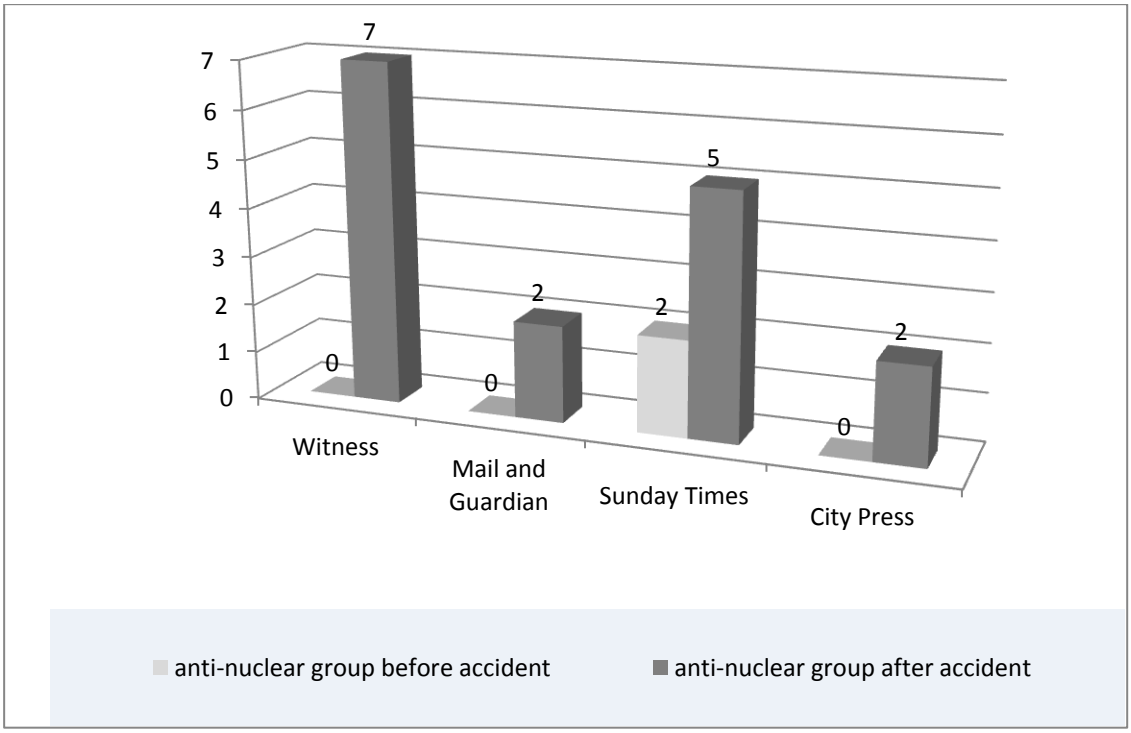

Figure 5.3: A comparison of the anti-nuclear themes reported in media prior to and after the Fukushima Daiichi accident. The data is for a year before the accident and a year after the accident.

Figure 5.4 shows that no relevant neutral articles appeared in the *Witness, Mail and Guardian* and *City Press* prior to the Fukushima Daiichi accident and only article was published in *The Sunday Times*. The reports that were published after the nuclear accident in the *Witness* and *City Press* are two and five, respectively. However, there has been an upsurge of publications in both the *Mail and Guardian* and *The Sunday Times*, recording twenty three publications apiece.

In Figure 5.5, the number of articles which carried both anti-nuclear and pro-nuclear themes is presented. The *Witness* and *City Press* newspapers carried no related articles in the year prior to the Fukushima Daiichi accident. Only a single article in both the *Mail and Guardian* and *The Sunday Times* featured during this time period. Four articles appeared in both *The Sunday Times* and the *City Press* after the nuclear accident. During this time period, *Mail and Guardian* published nine articles, while *Witness* newspaper published two articles.

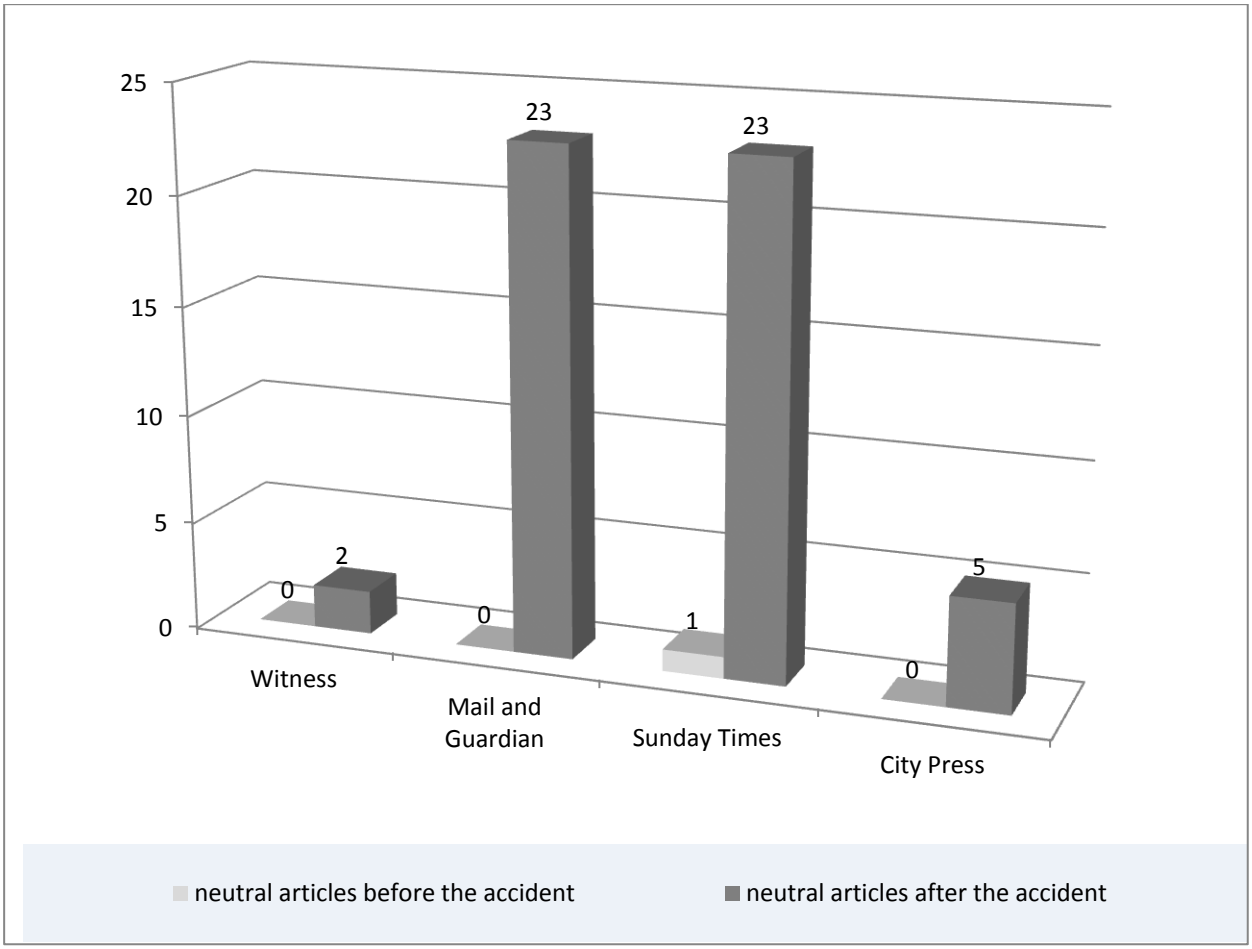

Figure 5.4: A comparison of the neutral themes reported in media prior to and after the Fukushima Daiichi accident. The data is for a year before the accident and a year after the accident.

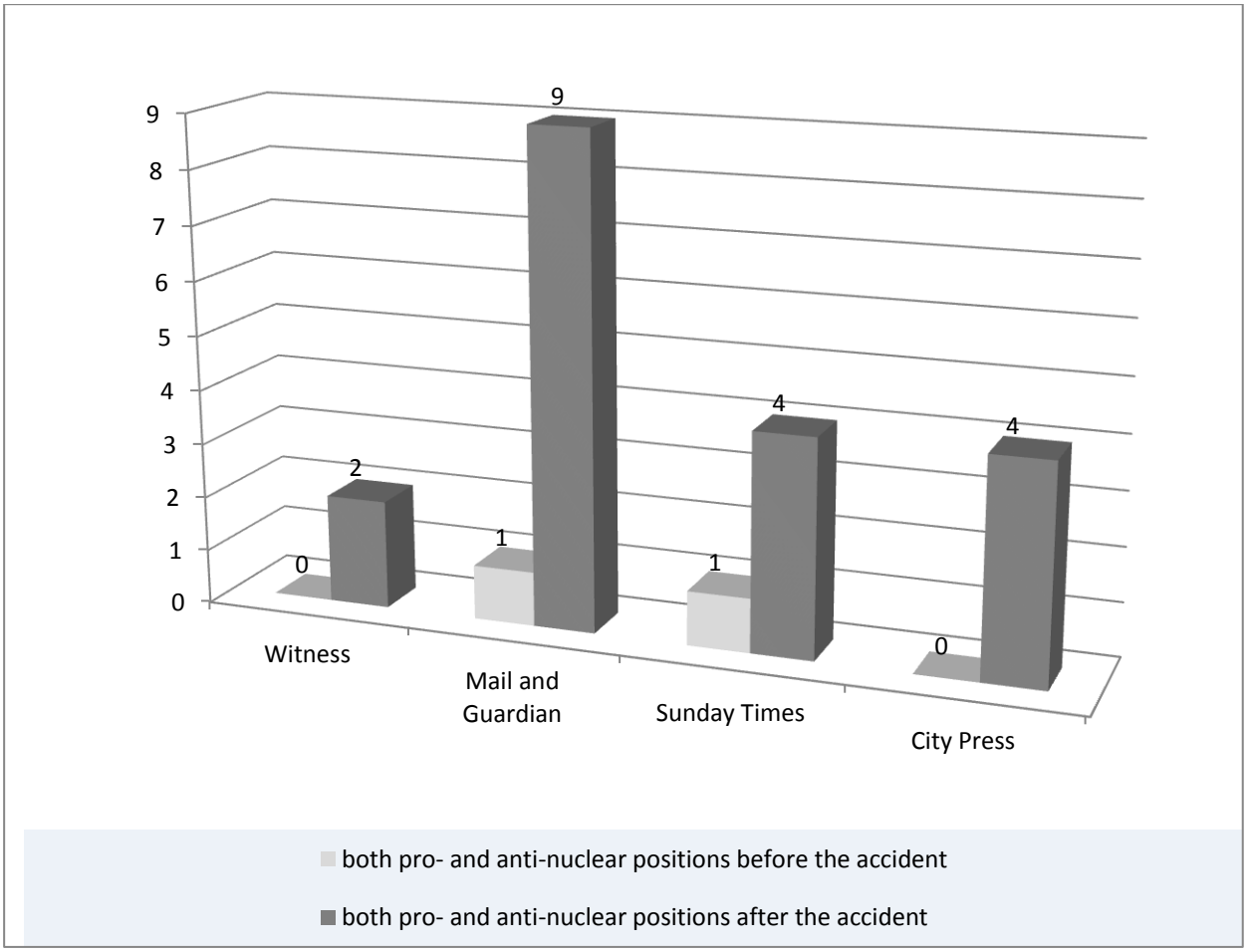

Figure 5.5: A comparison of the neutral themes reported in media prior to and after the Fukushima Daiichi accident. The data is for a year before the accident and a year after the accident.

Table 5.5 shows the pro-nuclear themes advocated by those in support of nuclear technology in South Africa and internationally. The data spans the time period: from 11 March 2010 (pre Fukushima accident) to post the Fukushima nuclear accident.

Table 5.5: Frequencies and percentages of the pro-nuclear activists on nuclear power discourse in South Africa and internationally. The articles were published in *Mail and Guardian*, *The Sunday Times*, *Witness* and *City Press* from 2010 onwards

Item / Factor	Frequency	Percentage
Nuclear power means progress	15	10
Jobs & economic security	25	16
Safe	21	13
Clean	12	8
Helps with climate change	12	8
Accessible	6	4
Cheap	8	5
Profitable	7	4
Essential for economic growth	31	20
Technological competence available in South Africa	12	8
Transparency of government and nuclear industry	4	3
Number of direct quotes/ citation by pro-nuclear activists	117	75
Number of indirect quotes/ citation by pro-nuclear activists	90	58
International bodies that support nuclear technology	10	6

The most conspicuous items from Table 5.5 are the number of direct and indirect quotes that reporters use in their articles. Articles that use direct quotes amount to 75%, which may possibly indicate that journalists prefer to quote the source rather than interpret the actual technical information presented by the source in an effort to minimise the misrepresentation of the information. Most of the indirect quotes lean more towards neutral point of view. Interestingly, statements that might invoke criticism, debates and further discussions come mostly in the form of direct quotes.

The data in Table 5.5 indicates that there is a somewhat strong veil of secrecy about nuclear technology. Only 3% of pro-nuclear activists in the nuclear industry believe that discussions around nuclear power are open and transparent or that journalists are making adequate enquiries about nuclear power in South Africa. This assertion is in line with the data reported in Table 5.2, whereby organisations tasked with the regulation and promotion of nuclear power in South Africa are the least contacted for

information on nuclear activities, possibly because their activities are not visible and transparent in the nuclear discussion platforms.

Table 5.6: Frequencies and percentages of the pro-nuclear activists on nuclear power discourse in South Africa and internationally. The articles were published in *Mail and Guardian*, *The Sunday Times*, *Witness* and *City Press* from 2010 onwards.

Item / Factor	Frequency	Percentage
Government politicians & designation	9	6
Anti-nuclear activists (specify organisation name and position)	32	21
Private Citizen cited (specify proximity to nuclear facility)	6	4
Academic / Professional / Specialist / Expert	28	18
Business community	1	1
Workers (including union)	4	3
Other (Specify)	4	3
Anti-nuclear themes		
Dangerous & unsafe	42	27
Health problems / illness / cancer	43	28
Nuclear reactors are expensive	30	19
Nuclear proliferation, sabotage, terrorism (tick appropriate)	16	10
Lack of transparency and mistrust	31	20
No lessons learned	22	14
Shortage of skilled workforce and aging workforce	1	1
Not suitable for South Africa	19	12
Investment into alternatives such as wind, solar, biomass or gas	22	14
Citing countries stopping nuclear power programs	13	8
Number of direct quotes/ citation by anti-nuclear activists	76	49
Number of indirect quotes/ citation by anti-nuclear activists	62	40

The brief highlights of Table 5.6 indicate that most journalists associate the words “dangerous and unsafe” with health problems rather than with expense or technological sturdiness of nuclear power. The anti-nuclear activists argue that nuclear technology is not suitable for South Africa and they generally point to other energy producing set ups such as wind, solar and gas as viable options that need to

be explored further, as well as listing first world countries that are moving away from the use of nuclear technology. Only 10% of anti-nuclear groups, as seen in Table 5.6, caution against nuclear proliferation, sabotage and terrorism as a major concern. To date there has not been any proliferation of nuclear material obtained from nuclear installations across the world diverted for non-peaceful purposes. The number of direct and indirect quotes from anti-nuclear groups is significantly lower than those of pro-nuclear activists. This could be linked to two factors: (i) either most journalists share and understand the anti-nuclear lobby sentiments a bit more than a pro-nuclear group, and do not rely on direct or indirect quotes to drive the message home, or the anti-nuclear groups are not regarded as a strong enough force to provide an alternative voice to the pro-nuclear groups that are led by those in political power. The anti-nuclear groups generally use lack of lessons learned from the Fukushima Daiichi, Three Mile Island and Chernobyl as a basis for their arguments. The anti-nuclear groups try to link lack of lessons learned to a lack of transparency and mistrust towards those who promote nuclear power (Dullay 2014; Diesel, 2013).

5.3 Conclusion

The main results of the study were presented in this chapter. More than 156 newspaper articles from *Mail and Guardian*, *The Sunday Times*, *Witness* and *City Press* were analysed and profiled using criteria specified in the coding sheet attached as Appendix B, Table 4.1: Frame matrix taken from Semetko and Valkenburg (2000:100) and Table 4.2: Overall attitude tones to nuclear technology after the Fukushima accident. The results indicate that there is a growing body of articles that are taking a neutral view since the Fukushima Daiichi nuclear accident, more than before the accident. The results also show an upsurge of anti-nuclear coverage in the media following the accident. The pro-nuclear themes have maintained a steady level of growth in the media coverage prior to the Fukushima accident, but scaled down a bit immediately after the accident.

CHAPTER 6

Discussions of the results

6.1 Introduction

The results presented in Chapter 5 on the newspaper coverage of nuclear power in South Africa, in relation to the Fukushima Daiichi nuclear disaster, are discussed in this chapter. The first part of the discussion focuses on media framing and the stand out themes observed for and against nuclear power before and after the Fukushima Daiichi accident. The second part mainly discusses the impact of frame-deployers in media coverage in South Africa. The results and discussions follow a qualitative approach.

6.2 General overview of the findings on nuclear power before and after the Fukushima Daiichi accident

The use of nuclear power everywhere, as in South Africa, appears to be more of a political issue than an economically sustainable tool, driven and controlled mainly by the government, rather than private market forces, and remains one of the most heavily regulated industries to date (AFP, 2014a; Hunter, 2014; Hattingh and Seeliger, 2002:25). The results, as presented in Table 5.1, indicate that journalists regard government officials as the authoritative source of information, with 135% compared to about 49% of all independent nuclear consultants, experts, academics and professionals put together.

There was strong international media coverage of pro-nuclear power themes long before the Fukushima Daiichi disaster (Adamantiades and Kessides, 2009: 5149–5166; Gamson and Modiglian, 1989:1-37), which consistently carried the following key messages: nuclear technology is a preferred technologically competent tool to generate electricity; nuclear power is a profitable economic source of energy; nuclear power infrastructure funding mechanisms are well established and have been successfully deployed in various countries; nuclear technology is safe, and important for economic growth and job creation; public acceptance and stakeholder

engagement have been key drivers in deploying new technologies the world over. The IAEA website has a rich database on the above subjects (IAEA, 2015). Some of these pro-nuclear themes will be discussed in the next section.

The results presented in the four newspapers examined for this study, however, indicate low key pro-nuclear themes, especially a year prior to and a year after the nuclear accident at Fukushima Daiichi. If one considers the time period from 11 March 2012 to 15 April 2015, one sees an upsurge of strong pro-nuclear themes, espoused mostly by authoritative sources. In more than 156 articles examined, 35 of these articles (22% of articles) provided strong pro-nuclear themes which were intermediated by sturdy anti-nuclear sentiments. Articles that carried both pro-and anti-nuclear sentiments that were published in the *Mail and Guardian* newspaper amounted to 40%, as shown in Table 5.3 in Chapter 5.

The articles that presented a neutral viewpoint on nuclear technology provide an interesting case for this study. Prior to the Fukushima Daiichi accident an aggregate of 10% of neutral articles appeared in all publications. After the accident, 60% of the neutral articles separate two contesting nuclear themes – pro-nuclear and anti-nuclear themes. This could well indicate that pro-nuclear groups have shifted their perceptions about nuclear technology by adopting a cautious and well-measured approach. This is aptly captured under the subsection on progress.

The next section focuses more on pro-nuclear themes prior to and after the Fukushima Daiichi accident. The media reporting on the pro-nuclear themes was extracted from the *Mail and Guardian, The Sunday Times, Witness* and *City Press.*

6.3 Pro-nuclear themes before and after the Fukushima Daiichi accident

Table 6.1, which provides a summary of Tables 5.2-5.5 from Chapter 5, indicates that the pro-nuclear themes were relatively dominant nuclear discourse drivers prior to the Fukushima Daiichi accident, especially if international data is also included in the analysis. In South Africa, about 34% of the articles take a pro-nuclear approach.

Table 6.1: Frequencies and percentages of pro-nuclear themes prior to the Fukushima Daiichi accident

Pro-nuclear media coverage		
Item / Factor	**Frequency**	**Percentage**
Technology competence	12	17.39
Profitable source of energy	7	10.14
Nuclear technology is safe	21	30.43
Nuclear energy is important for the economy	25	36.23
Public accountability, stakeholder involvement and participation	4	5.80
Total	**69**	**100.00**

Notes: Data comes from a subset of the all the newspaper articles used (N=69). Categories are not mutually exclusive since there is a strong information overlap. Data comes from the following sources: *Mail and Guardian, The Witness, The Sunday Times* and *City Press*.

6.3.1. Technological competence

Media coverage, in the case of pro-nuclear themes, highlighted the advantages brought about by nuclear technology, which extended to other fields, such as medicine, agriculture, desalination of potable water, heat production, and so on (Sapa, 2012; IAEA, 2012a). Media outlets and some authoritative research articles emphasised the idea that atomic power is a great asset for the industry because it is considered to be a highly specialised and competitive field. In South Africa, technological competence is mentioned in about 8% of the 156 articles. Generally, technological competence is coupled to narrative packages of responsibility described previously by Gamson and Modigliani (1989:1-37). These descriptive packages include the following elements:

6.3.2. Progress

Progress is the most promoted pro-nuclear power discursive package in the media coverage. This package has changed significantly through adaptability, flexibility and applicability over the years, but it remains visible in articles published in both the *Mail and Guardian* and *The Sunday Times* newspapers. Progress has been strongly

associated with industry mode of operation, regulatory framework, and government officials, interested nuclear groups that are most often cited by both these newspapers. Since pro-nuclear groups were frequently quoted in articles, it is not surprising that their voice is the most represented in the media outlets. The pro-nuclear groups use subtle words and frames such as “atoms for peace” (see IAEA logo in website www.iaea.org), “energy too cheap to meter”, “our friend the atom”, “safe and clean”, “not hotter than kitchen oven”, etc. (Desai, 2012:6,7; Butler, *et al.*, 2011:3-14). The results show 75% direct pro-nuclear quotes out of 156 articles examined in this study, which is relatively high compared to the anti-nuclear themes.

After the Fukushima Daiichi nuclear disaster, the pro-nuclear groups which advocate progress package have become defensive in their approach. Rather than depicting nuclear power as the ”pinnacle of modern civilisation, which would sustainably carry society into the future by providing for all of humanity’s energy needs” (Butler *et al.,* 2011:3-14), progress frames now regard the Fukushima disaster as a learning opportunity to be incorporated into future nuclear safety designs (Desai, 2012). Turning Fukushima Daiichi accident into an opportunity to improve, places nuclear technology as a continuously evolving technology that aims to become even more safe and efficient with improved nuclear regulation (Han, 2014:183-192).

This study reveals that the once relatively aggressively pro-atomic progress frame has now shifted towards a more complex ambivalent narrative after the accident in Japan. Desai (2012:15) has noted that:

> critics of nuclear power sometimes used the catch-phrases and terminology of the progress package. This immediately places the critic’s position in the realm of progress—because it is actually a pro-nuclear statement, agreeing that nuclear power is feasible if a few kinks in the technology are straightened out. While it might be a strategic position for stalling the promotion of nuclear energy, it does not question the validity of the technology itself.

The pro-nuclear articles examined post the Fukushima Daiichi accident in all selected South African newspapers, equate progress somewhat with acceptance. These articles clearly consider politicians, nuclear scientists and members of nuclear organisations to be the primary frame deployers. The nuclear catastrophe in Fukushima prompted, and to some extent embellished, the pro-nuclear narratives

used in support of nuclear power. Interestingly, government bodies such as Department of Energy (DoE), remained at the forefront of the media discourse, continually stressing the technological superiority of the atom, while blaming the anti-nuclear activists for their uncompromising stance, lack of ambition and accountability to the country, and pursuing foreign agendas without considering the material and economic conditions of this country. They imply that this is unpatriotic (Sapa, 2012).

While the Fukushima catastrophe received critical assessment in various newspapers regarding fears about nuclear energy and its risks, nuclear supporters in South Africa continued to maintain that nuclear power is an important integral part in the energy mix plan (IRP, 2010) in order to sustain economic growth while reducing the carbon footprint in South Africa. The deputy president, Mr Kgalema Motlanthe, commented previously by saying that:

> Nuclear power is ideal … because we can build large nuclear power plants at points around our southern coastline, and potentially elsewhere in the future…This is a strategically sensible approach which requires us to use other energy sources in addition to coal….However, it has become crystal clear that coal is not the long-term solution for our development needs…To this end our objective to deliver on these energy development imperatives requires short-term interventions to address immediate needs for basic electricity, followed by medium- to long-term sustainable and climate friendly energy development. Coal does not hold out prospects at the level of sustainable development (*City Press,* 2013).

The statements by deputy president Motlanthe are unambiguous about the nuclear expansion programme that South Africa intends to embark on in future. The core message expressed in the pro-nuclear media coverage revolves around the idea that the nuclear disaster at Fukushima Daiichi should lead South Africa to reassess, re-evaluate and therefore improve safety margins of its nuclear power installations. None of the statements indicates that South Africa should abandon its pursuit of nuclear energy. Supporters of atomic power deployed a greater number of media frames to showcase the advantages that nuclear energy has over other energy generation sources. Pro-nuclear media coverage following Fukushima resides around four key themes: (i) comparison of domestic nuclear progress with those of other countries; (ii) South Africa's safe nuclear programme; (iii) the importance of nuclear power to the domestic economy; and (iv) the unsustainable ways of other energy sources (e.g. coal-fired power stations) which are not suitable for an industrialised country. These themes are generally covered in this chapter.

6.3.3. Public accountability, stakeholder involvement and participation

Public accountability has been the most popular anti-nuclear package in the media, coupled to failures by regulatory bodies to impose punitive measures against infractions committed by nuclear power facilities. The Three Mile Island nuclear disaster, Chernobyl accident and now Fukushima Daiichi nuclear transgression have a common thread that runs through them. All these accidents were a result of departure from the approved safety procedures, processes and measures (passive and active) by operators. No one has been held accountable for all these accidents. In the last eight years, the American Nuclear Regulatory Council (NRC) found about 24 deliberate contraventions of safety regulations in America, but not a single company was penalised under the law (Kaufmann and Penciakova, 2011).

In South Africa, the Pebble Bed Modular Reactor (PBMR) project has committed a litany of regulatory breaches through placing of orders for components with manufacturing companies without formal approval of the NNR. The PBMR procurement activities were formally suspended by the regulator after few years, due to PBMR's continual and open defiance of the nuclear safety and quality regulations (NNR, 2008:56). No one was formally charged for these transgressions.

The nuclear safety system in Japan had been fundamentally flawed. In 2008, the IAEA had warned the Japanese government that their nuclear reactors were vulnerable to earthquakes as they were not designed to withstand massive seismic outbreaks. However, neither the IAEA nor the Japanese government did anything to improve the earthquake emergency preparedness of the Fukushima Daiichi nuclear plants (Uekoetter, 2012).

All the above incidents impact negatively on public accountability, stakeholder engagement and participation. Gamson and Modigliani (1989) noted that public accountability is often associated with ineptitude of industry and government, with an intentional effort to mislead the public for the sake of profit (Reuters, 2012). A typical example is "Tokyo's handling of the nuclear crisis -- which has veered between apparent competence at some times and seeming helplessness at others -- bodes ill as millions continue to suffer without basic necessities" (Auslin, 2011); "Japan's

nuclear safety chief said the country's regulations were fundamentally flawed and laid out a somber picture of a nuclear industry shaped by freewheeling power companies, toothless regulators and a government more interested in promoting nuclear energy than in safeguarding the health of its citizens" (Tabuchi, 2012). These sentiments were also observed in the South African nuclear industry as reported by Adams (City Press, 2012):

> South African government is pushing ahead with its nuclear plans to build six new nuclear reactors without public consultation or space for engagement… It is hugely irresponsible for government to believe that they can spend billions of taxpayers' Rands on such dangerous and expensive technology without being transparent, or without any kind of public debate… The South African government must stop the push to build six nuclear reactors and, instead, engage with citizens and provide platforms for honest and open debate. There are far too many questions left unanswered and all South Africans have a right to know where such a huge amount of money will be spent.

The next section looks at runaway descriptive package as described by Gamson and Modigliani (1989:1-37) and its applicability to this research project is evaluated.

6.4 Runaway

Runaway package projects a fatalistic attitude about nuclear power by categorising nuclear as an inevitable 'accident waiting to happen' and paints a gruesome picture of the health effects of radiation (Gamson and Modigliani, 1989:1-37). Runaway is often fairly portrayed within the 156 articles examined. Some clips commensurate with a runaway package from the articles featured some desperate Fukushima Daiichi nuclear plant workers frantically trying in vain to bring the reactors under control. "We don't know what we should do," remarked one nuclear specialist at Fukushima Daiichi (Obe and Dvorak, 2011).

Although runaway enjoyed less representation than progress and public accountability, it remained the commonly descriptive package in the editorial and commentary portions of the articles published in *The Witness* newspapers (Witness, 2011).

If the press indeed mirrors the public attitude precisely, then runaway would most likely be the most representative package that the South African public identifies with.

Butler *et al* (2011:7) concluded that public opinion towards nuclear technology appears to be the one of "conditional or reluctant acceptance at best". This approach is a trait of the runaway package, and it is exactly this approach that appears to underscore most of the other packages described in the newspaper articles examined for this study. It appears, however, as if runaway has somewhat found its way into national nuclear discourse, almost unintentionally.

6.5 Sustainability of nuclear power

Nuclear power has been projected as one of alternatives to mitigate against climate change because of its insignificant green-house gas emissions. Prior to Chernobyl, Three Mile Island and the recent Fukushima Daiichi nuclear disasters, nuclear power attracted less public opposition than coal-fired power stations. The trend changed in 2005 when people reluctantly accepted nuclear power as a solution to climate change effects (See Pidgeon, Lorenzoni and Poortinga, 2008:69-85). In fact, most articles examined post-Fukushima Daiichi disaster appear to cast nuclear power in a negative way when associated with global warming (Dullay, 2014; Faull, 2013; Kings, 2014).

Desai (2012:18) noted that in spite of the highly publicised hype around global warming, the pro-nuclear packages are not prominent due to the defensive posture that the nuclear industry has taken after the Fukushima Daiichi accident. According to Desai (2012:13), the pro-nuclear activists are more interested in convincing the public that nuclear power is safe, necessary and affordable, but do not highlight the concomitant risks that come with nuclear power technology.

6.6 Profitable energy source

Prior to the Fukushima Daiichi nuclear disaster and now recently (after a lull period), nuclear power has been widely regarded by the media as profitable, cheap, environmentally friendly and a sustainable source of energy over long-term, as reflected in Table 5.5 in Chapter 5. Besides the prominence of pro-nuclear direct and indirect quotes, nuclear is seen as essential for economic growth, appearing at a rate of 20%. Strictly speaking, the rate of 16% attributed to job and economic security could easily form part of the economic growth rate. The media coverage highlighted

how the South African economy and the nuclear industry could maintain a lucrative source of energy, with uranium stock prices steadily rising and a large uranium stockpile (Donnelly, 2014). Media coverage scarcely highlighted the profitability of nuclear energy, coming as only 4% from the 156 articles examined.

In fact, throughout the pre-Fukushima period relatively fewer journalists from the newspaper outlets examined in this research seemed eager and enthusiastic about the future of nuclear technology in this country. To the South African government, nuclear expansion was regarded as a matter of “when” rather than of “if”, especially when the world is strongly battling against the negative effects of climate change (Pringle, 2010; Adamantiades and Kessides, 2009:5149–5166). As reported in this study, the sentiments of these pro-nuclear groups changed to neutral communicative packages after the Fukushima Daiichi nuclear accident.

6.7 Nuclear energy is safe and important for the economy

The findings show that the use of nuclear energy in South Africa is more of a political issue than one of environmental sustainability. The safety of nuclear technology is attributed not so much to its sturdy application as to its importance to the South African economy, security of energy supply and job creation. The findings reveal that the promotion of nuclear technology by the Government is implemented without considering the views of opposition parties, with little public accountability and no stakeholder involvement and participation (Diesel, 2013; City Press, 2012a).

6.8 Anti-nuclear media coverage in South Africa before and after the Fukushima Daiichi accident

The controversial nature of nuclear power has periodically courted protests and huge criticisms among the South African public, even well before the Fukushima accident, especially when project costs associated with nuclear expansions grew beyond control. The case in point was the Pebble Bed Modular Reactor Project (PBMR) (Kassier, 2013). PBMR, an Eskom subsidiary nuclear project, had spent over R9 billion over 11 years with the aim to design, construct, commission and operate a licensed nuclear power plant in South Africa (Wild, 2013). PBMR was to have been commissioned sometime in 2002, a date which was later rescheduled to 2006;

however, at the time of project closure in 2010, the engineering design was far from complete. Costs overruns on the PBMR project led to upsurge of criticism about nuclear power technology in South Africa, with the group: Environmental Earthlife Africa the loudest voice – captured in no less than 15 articles published in various media outlets between 2010 and 2011(Govender, 2010; Pringle, 2010).

Before Japan's Fukushima Daiichi nuclear catastrophe in 2011, newspaper coverage of nuclear power, in *Mail and Guardian, Witness, City Press* and *The Sunday Times,* rarely challenged the fundamental idea that South Africa should use nuclear power as a supplementary source of energy. The reason could possibly be linked to the fact that no more than 5% of the total energy use in South Africa is extracted from nuclear power, as well as the fact that the only power station in the country, Koeberg Nuclear Power Plant, has been in operation for more than 30 years with no major safety incident reported.

The interest of writers only turned to nuclear debates when the country experienced continual load shedding of electricity. Historically, negative newspaper articles did not question the use of nuclear energy outright in South Africa. Media coverage before the Fukushima accident rarely mentioned the dangers associated with nuclear energy. Instead, prominent themes that had arisen as critical or "anti-nuclear" revolved around management of nuclear waste, possibilities of terrorism, sabotage, nuclear proliferation, radiation and uncontrollable spread of radioactivity (refer to group 3 factors in Chapter 3).

The entries in Table 5.6, presented as Table 6.2, generally discuss anti-nuclear themes before and after the Fukushima Daiichi accident.

Table 6.2: Frequencies and percentages of prominent anti-nuclear themes prior to and after the Fukushima Daiichi accident

Item / Factor	Frequency	Percentage
Government politicians & designation	9	6
Anti-nuclear activists (specify organisation name and position)	32	21
Private Citizen cited (specify proximity to nuclear facility)	6	4
Academic / Professional / Specialist / Expert	28	18
Business community	1	1
Workers (including union)	4	3
Other (Specify)	4	3
Dangerous & unsafe	42	27
Health problems / illness / cancer	43	28
Nuclear reactors are expensive	30	19
Nuclear proliferation, sabotage, terrorism (tick appropriate)	16	10
Lack of transparency and mistrust	31	20
No lessons learned	22	14
Shortage of skilled workforce and aging workforce	1	1
Not suitable for South Africa	19	12
Investment into alternatives such as wind, solar, biomass or gas	22	14
Citing countries stopping nuclear power programs	13	8
Number of direct quotes/ citation by anti-nuclear activists	76	49
Number of indirect quotes/ citation by anti-nuclear activists	62	40

About 25% of nuclear opponents and sceptics argue that the reasons for development of the nuclear power in South Africa are deceptive and are fundamentally flawed (Nagel, 2011). The discontent about nuclear power became evident after the Fukushima Daiichi accident, as reflected by an average of 25 anti-nuclear articles within 12 months after the Fukushima accident. The next section examines this dissatisfaction.

6.9 Problems with Nuclear Waste

Most of the nuclear discourse centres around the issue of nuclear waste (Diesel, 2013; Dullay, 2014). The main bone of contention is the apparent difficulty of the nuclear industry to offer viable and sustainable solutions to the management of radioactive waste without undue consequences to the environment, structures and systems (Diesel, 2013). The issue of nuclear waste had received negative rating or critical coverage in news media outlets over many years, mainly from the liberal press such as the *Mail and Guardian*. In fact, most of the debate is over the processing and storage of nuclear debris, including the effects of long-lived isotopes such as Caesium -137, Iodine-131, Strontium and Plutonium-239 with the latter having a half-life of 24000 years (Vicente and Wild, 2014a; Schell, 2009). The spread of radioactive waste and food irradiation have been widely reported since the Fukushima accident, extending to countries outside Japan such as China (*Sunday Times*, 2011).

Nuclear waste has been acknowledged as a serious and contentious problem facing the nuclear industry for a considerable time now (IAEA, 1999). This has often triggered a sustained public outcry that the nuclear industry must recognise and address current dangers posed by nuclear waste, rather than abandon this issue for future generations to grapple with (Wilkinson, 2007:218-220). Disposing nuclear waste into deep repository temporarily or permanently does not constitute a complete solution to dealing with nuclear waste debris (Vicente and Wild, 2014). The question of nuclear waste still has to be answered (Vogt, 2012:40). Anti-nuclear activists, quoted mostly in *Mail and Guardian*, and sparsely in *The Sunday Times*, argue that as long as nuclear organisations do not find a solution to the processing of the nuclear waste, nuclear power does not constitute a viable solution to South African electricity crisis, more so than the renewable energy sources (Sapa, 2012).

In the months prior to the Fukushima nuclear disaster, nuclear waste in South Africa was by far the issue that received the most criticism with the government highlighting that it is at the final end of establishing a national radioactive waste disposal institution (NRWDI) to deal with issues related to radioactive waste (Sapa, 2012). Such an assurance by the energy minister and the deputy president did not stop

internal feuding about nuclear power in South Africa. The next section closely examines the in-fighting of important stakeholders in the nuclear industry in South Africa.

6.10 Wrangling within the South African nuclear industry

There appear to be constant tensions amongst important stakeholders within the nuclear industry. In one of the press briefings, the energy minister, Ms Dipuo Peters, responded to the uncompromising attitude of Greenpeace nuclear debates by saying: ”[Greenpeace] don’t want nuclear, you don’t want hydro, coal. It’s important they understand we are an energy intense economy” (Sapa, 2012). The director general of the department of energy was also reported to have said: “If the government wants nuclear, I will make sure they get it” (Davies, 2014).

The estimated cost of the new nuclear fleet that the government wants to invest in would be between R300 billion and R1 trillion. This is a significant price difference of up to 70%. According to the Energy minister, Dipuo Peters, R300 billion has been allocated to nuclear power in the energy budget as “*only the starting point*” (Adam, 2012). According to anti-nuclear activists, such a price difference simply reflects that there is no clear scientific approach to estimating costs associated with a nuclear programme, especially for commissioning and decommissioning. It should be noted that none of the decommissioning work carried out to date has been within scope, time and cost. In the United Kingdom alone, the decommissioning cost for some of the nuclear facilities increased from about US$84 billion (2005) to US$108 billion (2006) and to US$110 billion (2008) (NDA, 2008:27). The government of Japan has estimated the decommissioning process of the damaged reactors at Fukushima Daiichi would cost at least 1.15 trillion yen (about R120 billion) (Adam, 2012). This decommissioning value has recently been revised upwards to $100 billion (about R1 trillion) which is 88 % more than the initial estimate (McCurry, 2013). This means the price associated with nuclear power technology is extremely high with very little return, argues the Environmental Earthlife SA activist: “It's reckless insanity to continue with the nuclear programme in South Africa,” says Tristan Taylor, spokesman for Earthlife SA (Nagel, 2011). This sentiment was further underscored by one environmental activist who asserted that “…Our mad pursuit of a coal and

nuclear mix, at the cost of marginalising renewable energy, is not just ludicrous — it is dangerous for the economy" (Dullay, 2014).

Anti-nuclear activists point to a steady increase of countries that are moving away from nuclear technology, such as Germany and Switzerland, with Japan planning to phase out its nuclear power in the 2030s, in favour of alternatives such as solar, wind and biomass (Reuters, 2011; Diesel, 2011). This move is widely interpreted as a sign that nuclear technology has failed dismally to provide sustainable economic growth (Blackmore 2013: 44-87).

In South Africa, critics of nuclear energy have claimed the government is colluding with nuclear proponents in the nuclear industry against anti-nuclear groups, and keeping a veil of secrecy in order to control nuclear regulations as well as influence public opinion (Adam, 2012; Nagel, 2011). The anti-nuclear activists have pointed out that South Africa is not ready for nuclear power technology, as seen in the following quotes from the examined newspapers:

> South Africa had no reason to think that its ability to ensure nuclear safety is better than in a highly technological country like Japan", & "South Africa does not have sufficient regulatory capacity to safeguard the public from nuclear risks posed by an additional 9 700MW [as outlined in the integrated resource plan of 2010] of nuclear power" (Donnelly, 2011).

> It proposes emergency zones of 800 metres and 3 kilometres. Anyone who has been in the areas around Chernobyl or Fukushima would agree that such a proposal is misleading or simply outrageous (Donnelly, 2011).

> The department (of energy) has no competency. They are weak. They want to lead a process that is 100 times bigger than they can manage (Kgosana, 2012).

> If an economic powerhouse such as Germany can do without atomic energy, surely we in South Africa, being much more generously endowed with renewable energy resources, should be able to do the same? Considering the intransigent problems posed by nuclear power, among them the security, environmental and health risks, the high cost of building new nuclear infrastructure and the radioactive waste nobody knows what to do with, we owe it to ourselves and future generations (Späth, 2011).

These statements highlight the polarisation and the intensity of the internal wrangling within the South African nuclear industry. Based on the above conflicts within the

nuclear industry, the next section examines the general criticism of South Africa's stance on nuclear technology.

6.11 Criticisms of latest South African nuclear technology stance

It has been noted by the level of media coverage in the pre-selected newspapers that nuclear discourse prior to the Fukushima Daiichi accident had not taken a strong anti-nuclear position, but it did periodically invoke negative tones and criticisms of the industry, including the dysfunctional relationships within the industry. Regardless of the general tone of the newspaper, reporters always reflect the hesitations and concerns expressed by the authoritative sources, e.g. government organisations, regulatory agency, nuclear specialists, and so on.

The most critical concern raised by anti-nuclear movement is the issue of nuclear waste management, terrorism, sabotage and proliferation of nuclear material. These issues are discussed from section 6.4.4. Liberal media outlets, such as *Mail and Guardian*, provided a majority of critical coverage compared to conservative media outlets such as *The Sunday Times*. Interestingly, articles that deal with nuclear waste from a negative point of view tend to ignore other aspects associated with nuclear power technology. Thus, it is difficult for the general public to obtain a balanced picture of nuclear power from anti-nuclear activists. In addition, anti-nuclear groups preferred to publish their articles in liberal newspapers, ignoring other so-called conservative (or more mainstream) media outlets. One can therefore summarise that there was less critical media reporting on nuclear power prior to the Fukushima Daiichi disaster, although this was not consistent.

6.12 Terrorism, sabotage, proliferation, radiation and spread of radioactivity

Between 2010 and 2012 none of the newspapers examined with regard to the Fukushima Daiichi nuclear catastrophe mentions terrorism or sabotage as a potential cause of accidents. The idea of terrorism and sabotage comes into play due to the immeasurable damage that nuclear catastrophe can have on the environment, people and structures. None of the nuclear accidents to date can be linked to terrorism or sabotage, but all are mainly due to human error (Hattingh and Seeliger, 2002:57).

Mail and Guardian, Witness and *The Sunday Times* newspapers carry no articles on nuclear proliferation between 2010 and 2012. This means that matters related to nuclear proliferation are not critical and decisive in nuclear debates both pre and post era of Fukushima Daiichi accident. For completeness to this section, it should be noted that South Africa remains the only country among the nuclear states to voluntarily abandon a nuclear weapon development programme which was initiated around 1970. South Africa had nuclear warheads ready by late 1970s. The weapons programme was finally closed down by President de Klerk in 1990. In 1991, South Africa signed the Nuclear Non-Proliferation Treaty (NPT) with IAEA. In 1993, President de Klerk announced the dismantling of the six completed nuclear warheads. In 1995, the IAEA proclaimed South Africa as a nuclear weapon free country. During 1996, South Africa signed the African Nuclear Weapon Free Zone Treaty – also referred to as the Pelindaba Treaty, with additional safeguard protocols appended in 2002 with the IAEA (Hattingh and Seeliger, 2002:31).

The next section considers the anti-nuclear media coverage before and after Fukushima Daiichi nuclear disaster.

6.13 Anti-nuclear articles after the Fukushima Daiichi disaster

The nuclear accident at Fukushima Daiichi has drawn a sharp line in the coverage in the debate over the nuclear energy in South Africa and elsewhere in the world. Both anti-nuclear and pro-nuclear current articles advocate themes that are distinctly opposite and are in conflict on nuclear subjects prior to the disaster. The overall tone of the debate has clearly shifted in favour of the aggressive anti-nuclear group. Anti-nuclear themes that arise in the study period following the Fukushima disaster include (Group 1 factors in chapter 3): (i) Nuclear power is dangerous; (ii) Nuclear accidents can occur in South Africa; (iii) Lack of transparency and debates in the nuclear field; (iv) Investment in nuclear power alternatives is critical; (v) No lessons learned from past nuclear disasters; and (vi) Suitability of nuclear power in future. These themes are discussed in the sections below.

6.13.1 Nuclear power is dangerous

The prevalent theme in the media coverage and in the literature, post the Fukushima Daiichi disaster, revolves around the dangers that nuclear power poses to the environment, society and structures. Nuclear power is seen as uncontrollable and dangerous. This theme makes up about 90% of the articles. Fukushima Daiichi precipitated vehement and strong reactions from anti-nuclear activists throughout South Africa and resurrected the movement that has generally operated in small pockets of influence for many years. All four newspapers have published quotes from the anti-nuclear advocates warning the general public against the risks and dangers of nuclear power, especially the dangers associated with nuclear waste. See Blackmore (2013: 44-87) and Lock *et al* (2014:428-435), about public perception of nuclear power waste material after the Fukushima disaster. These are some of the quotes

> "It sounds dangerous…how long can you store it?"
>
> "How safe would it be?"
>
> "Where is the carbon to be stored?"
>
> "Do we think it would be safe?"
>
> "What about the fish?"
>
> "But how long do you have to store it before it affects something?"
>
> "I mean won't there be side effects and environment problems. We are already facing these global warming things, but wouldn't that… if you put the gas underneath…" Lock *et al.*, (2014:431,432).

The Fukushima nuclear accident has brought about the realisation of the tremendous consequences a nuclear accident could have for the entire country. Sadly, nuclear debates only occur in earnest in the wake of a disaster. According to Blackmore, Chernobyl and now Fukushima Daiichi, disasters have "increased the experiential commensurability of the anti-nuclear movement's risk frame, which in turn increased its resonance" (Blackmore, 2013:60).

The advocates of anti-nuclear power have pointed out failures to learn from previous disasters. “From Three Mile Island, to Chernobyl and now Fukushima Daiichi, it seems that we have learned nothing.” Interestingly, the proponents of nuclear power consider Fukushima accident as part of learning curve that needs to be taken into account with the expansion of future nuclear technology infrastructure, hence the new stress tests currently undertaken by IAEA member states (IAEA, 2013). Koeberg nuclear power plant (KNPS) in South Africa has successfully completed the safety stress test against extreme abnormal occurrences (NNR, 2012). The nuclear experts warn that unless nuclear power is treated with caution, it would indeed remain a dangerous tool to generate energy (See Netzer and Steinhilber, 2011)

6.13.2 Nuclear accidents can occur in South Africa

South Africa is not immune to nuclear accidents. The nuclear accident in Japan exposed some serious shortcomings in world nuclear safety systems and applicable regulatory frameworks. There has been mounting concern about the threat of potential seismic activity in South Africa. According to a geologist, Chris Hartnady, large earthquakes could still happen in South Africa, even though the country is not renowned for volcanic or seismic activities. In 1809, South Africa recorded an earthquake of magnitude 6.5 on the Richter scale in Cape Town (Donnelly, 2011). It is unclear if KNPS has been designed and constructed to withstand potential effects of earthquakes of 6.5 magnitude or higher.

However, the method used to estimate possible earthquake occurrences and predict their magnitudes relies on the empirical data of previous earthquakes in that area. Such a method might be unsuitable and fundamentally flawed for South Africa due to lack of data (Donnelly, 2011). KNPS was constructed in 1978 and it is now near its end of life. Structures, Systems and Components (SSC) of KNPS have significantly deteriorated over the operational and maintenance years. Unless SSC are completely revamped, KPNS is set for decommissioning by 2038, since the lifetime of a nuclear plant is, on average, sixty years.

6.13.3 Lack of transparency in South African nuclear industry

Lack of transparency in nuclear discourse, post the Fukushima Daiichi accident, has been highlighted strongly in the newspaper articles, as profiled in Table 6.2. Anti-nuclear activists claim that the South African government, together with their proponents in the nuclear industry, are purposely concealing information from the public. Such actions by the government and the nuclear industry deliberately curtail and shape nuclear debates in South Africa, with most arguments based on shaky and uninformed grounds.

Reporters argue that the general public is, to all intents and purposes, excluded from the discussions about the development of the nuclear industry because authoritative sources tend to have the upper hand in the discourse, and as such do not want to change their policies. These actions go against the grain of handling questions on nuclear energy development in South Africa. Instead of allowing the experts to debate the nuclear issue, using complex and inaccessible language, the government needs to establish a framework that would foster involvement and participation of the general public in nuclear discourse. It is “clear the country did not have the skills or capacity to tender for, or to build, a fleet of new nuclear power stations. The lack of transparency over such a large decision where we could be spending trillions of Rands could not go unchallenged” (Donnelly, 2012).

Media coverage of anti-nuclear activists reflects the fact that pro-nuclear actors seem unconcerned about the public’s perceptions of nuclear power. The leading pro-nuclear activists argue that South Africa should have increased its reliance on nuclear energy a long time ago, even before the Chernobyl nuclear disaster, and might therefore not change its course on nuclear expansion based on a largely man-made nuclear accident in Japan. However, we have witnessed a significant shift in media coverage of nuclear power following the Fukushima nuclear accident, both in terms of the volume and substance of anti-nuclear coverage.

Before the accident at Fukushima Daiichi power plant, the critical and anti-nuclear articles in South Africa print media were largely concerned about nuclear waste management, and quite recently, on PBMR technology. Following the Fukushima

accident, the anti-nuclear coverage highlights much stronger criticism of the industry, including calls to stand against nuclear power expansion. Anti-nuclear supporters have strongly reproached the South African government and the main nuclear organisations (Necsa, Eskom, NNR, Niasa and PBMR) for concealing and controlling levels and volumes of information and thus refusing to open the debate to the public, which ultimately had a knock-on effect on the public confidence level toward the use of atomic power.

6.13.4 Investment in nuclear power alternatives

About 14% of authoritative sources have pointed out that South Africa should consider alternative energy sources to nuclear power. These groups have substantiated their arguments by pointing at countries that are moving away from nuclear technology. These countries, it is claimed, have superior nuclear technology and know-how compared to South Africa but have still decided to abandon the nuclear programme. Although the rate at which the anti-nuclear groups who questioned the suitability of nuclear power for South Africa is low at 12%, their message is very aggressive, possibly because their voice is drowned by pro-nuclear themes, which appear to enjoy extensive media coverage.

6.13.5 No lesson learned from past experiences

Between 2010 and 2011, no articles in either *Mail and Guardian* or *The Sunday Times* refer to lessons learned about nuclear activities in South Africa and elsewhere. Only one article reports on failures to learn from the aftermath of Chernobyl and Fukushima Daiichi nuclear disaster.

6.14 Official frames and frame deployers

The final section of the research project aims at examining issues related to frame deployers. The findings of this study indicate that access to the media is not the same for all actors in the nuclear debate. This is in line with the general outcomes arrived at by various authors. In brief, past studies showed that media outlets are powerful tools for shaping public debate (Gamson and Modigliani 1989; Ryan 1991; Gamson 1992;

Gamson, Croteau, Hoynes, and Sasson 1992; Smith 1996; McCaffrey and Keys 2000; Rohlinger 2002). Researchers emphasise the influence of “official frames” in the construction of narratives (Gans 1979; Ryan 1991; Barker-Plummer 1997; Rohlinger 2002; Gans 1979; Gitlin 1980; Klandermans 1988; Ryan 1991; Rohlinger 2002).

Media outlets have only limited space to cover issues and the literature emphasises the necessity for reporters to choose which news is worth publishing (Entman 1993; Koopmans 2005; Neidhardt 1994; Noakes and Johnston 2005). Thus, because of the lack of space, journalists tend to rely on government or nuclear managers to get information about the field. Anti-nuclear activists have been largely neglected in the SA media, particularly in the period preceding the Fukushima accident. This has effectively prevented their frames from resonating with the South African population, and has limited the public consumption of critical information on the nuclear industry in South Africa. Frame resonance plays an important role in the success of a social movement (Ryan 1991; Gamson and Modigliani 1989; Noakes and Johnston 2005). That is why it is important for social movement organisations to understand the tactics of the media in order to get better attention from the media and the journalists.

Data from two of the newspapers examined in this study, *Mail and Guardian* and *The Sunday Times,* shows that the distribution of deployers of “official” frames on the one hand, and anti-nuclear activists on the other hand, is uneven. The distribution of pro-nuclear and anti-nuclear sentiments since 2010 is summarised in Table 5.5 and Table 5.6 in chapter 5. The government officials appear, from Table 5.5 and Table 5.6 to express the greatest support for nuclear energy in the media.

Fukushima represents an interesting dividing point in analysing the distribution of the frame deployers. In all the newspapers examined, there is a strong reliance on politicians, and not on scientists and experts, in providing ‘insightful’ information about nuclear technology.

The distribution of anti-nuclear deployers changes significantly after the nuclear catastrophe at Fukushima. The importance of journalists’ opinions decreases significantly even if it remains present in a high number of publications (47.91%). This

evolution is significant at $p<0.001$. However, media outlets tend to rely more heavily on politicians opposed to nuclear energy (20.93 %) and on anti-nuclear activists (19.07 %). It is interesting to see that experts are used more frequently after Fukushima as pro-nuclear deployers. Reliance on these experts nearly doubled following Fukushima, but remained fairly small (3.49 % and 6.61 %respectively). The nuclear catastrophe in Fukushima also resulted in more analysis of the nuclear situation in RSA by experts or members of the scientific community. In the same way, scientists who support nuclear technology provided their assessment of the situation.

The analysis of the deployers of the frames in the media increases our understanding of the dynamics of the coverage of the debate over the nuclear industry. Anti-nuclear activists are cited far less often in the articles examined in this research than deployers of official frames such as the SA government.

6.15 Results from the propositions

The results for the propositions made in Chapter 4 are summarised in Table 6.3. Propositions are statements that express opinion or judgement and are used to test the validity of the information without going through an in-depth analysis.

Table 6.3: Results according to propositions investigated in this study

Research objective	Label	Propositions	Frame Matrix
To establish whether or not the Fukushima Daiichi nuclear accident has altered the narratives about nuclear power in the South African print media	P0	The Fukushima Daiichi nuclear accident did not alter nuclear debates in South Africa print media	P0 is false. P1 is true. There has been an upsurge of newspaper articles published a year after the accident than before (88 vs 10). See Table 5.4.
	P1	The Fukushima Daiichi nuclear accident triggered serious nuclear debates in South African print media	
To investigate if new narratives and trends are developing following the aftermath of the Fukushima Daiichi nuclear disaster	P0	There are no trends developing concerning nuclear discussion in the SA print media after the Fukushima Daiichi nuclear accident	P0 is false. P1 is true. More than 45% of the newspaper articles follow a neutral theme after the Fukushima Daiichi accident. (See Table 5.3).
	P1	There is an emergence of trend setting in the SA print media after the Fukushima Daiichi nuclear accident	
To examine which types of sources are given voice to in the media as well as how the media portrays these source groups.	P0	There is no preferred source / voice in the SA print media on nuclear position after the Fukushima nuclear accident	P0 is false. P1 is true. There is strong lineage of most anti-nuclear articles in liberal newspapers such as *Mail and Guardian* and strong pro-nuclear articles in conservative newspapers such as *The Sunday Times*.
	P1	There is a strong preference for a particular source / voice in the SA print media on nuclear power position	

6.16 Results of the hypotheses

The following hypotheses were tested in the study, decoupled into H0 (null hypotheses) and H1 (research hypotheses). The Chi square results were interpretated based on the information based on Table 6.4.

Table 6.4: Interpreting the Chi Square results

if	Then	Outcomes
p value < a	Reject the null hypothesis	Variables are related
p value > a	Cannot reject the null hypothesis	Variables are independent

6.16.1 Hypothesis #1:

H0: The accident at Fukushima Daiichi Nuclear Power Plant did not have any effect on the constructed image of nuclear power in the South African print media. In other words; it is assumed that the image of nuclear power remains unaltered and is independently built regardless of the focus given to nuclear accidents by the media;

H1: The accident at Fukushima Daiichi Nuclear Power Plant had a profound effect on the constructed image of nuclear power in the South African print media.

To test this hypothesis, the pro-nuclear entries in Table 5.5 and the anti-nuclear entries in Table 5.6 were consolidated as follows: All the pro-themes were added up including from articles that have both pro and anti-nuclear themes. The same was done for all anti-nuclear themes. The focus was placed on articles published a year before - and a year after - the Fukushima Daiichi accident. The results are summarised in Table 6.5.

Table 6.5: Frequency distribution a year before and a year after the Fukushima Daiichi accident.

Test	Item	Before Fukushima Accident	After Fukushima Accident	Total	Outcome
T1	Pro-nuclear themes	18	27	45	The Chi-square statistic is 5.0238. The *p* value is 0.025001. This result is significant at $p < 0.05$. The null hypothesis can be rejected since there is a strong correlation between variables
	Anti-nuclear themes	15	57	72	
	Total of samples	33	84	117	

6.16.2 Hypothesis # 2:

H0: The accident in Fukushima Daiichi Nuclear Power Plant did not ignite new public debate in the South African print media with respect to the use of nuclear power, thereby contributing to a positive image about this technology.

H1: The accident at Fukushima Daiichi Nuclear Power Plant ignited huge new public debates in the South African print media with respect to the use of nuclear power, thereby contributing to a positive image about this technology.

To test this hypothesis, the pro-nuclear and anti-nuclear themes a year before and a year after the accident are analysed, based on direct and indirect quotes. The quotes also include those from newspaper articles profiled as both the pro-and anti-nuclear articles.

Table 6.6: Frequency distribution a year before and a year after the Fukushima Daiichi accident.

Test	Item	Before Fukushima Accident	After Fukushima Accident	Total	Outcome
T2	All pro-nuclear quotes	7	77	84	The Chi-square statistic is 2.6209. The *p* value is 0.105462. This result is *not* significant at p < 0.05.The null hypothesis cannot be rejected since variables are independent.
	All anti-nuclear quotes	7	31	38	
	Total of samples	14	108	122	

6.16.3 Hypothesis #3:

H0: Media debates do not portray or promote a particular voice, stories or sources, with regard to nuclear energy policy change in South Africa.

H1: Media debates portray or strongly promote a particular voice, stories or sources, with regard to nuclear energy policy change in South Africa.

To test this hypothesis, the authoritative sources for pro-nuclear and anti-nuclear are compared a year before and a year after the accident at Fukushima Daiichi nuclear power plant. In the case of pro-nuclear, authoritative sources are made up of a combination of government officials, Eskom, PBMR, Necsa, NNR, private citizens, professionals, business community, Niasa, Nuclear workers and other international organisations.

The anti-nuclear authoritative sources are composed of government officials (mostly opposition political parties), anti-nuclear lobby groups, private citizens, professionals, business community, nuclear workers and other international bodies (see the coding sheet in Appendix B).

Table 6.7: Frequency distribution a year before and a year after the Fukushima Daiichi accident.

Test	Item	Before Fukushima Accident	After Fukushima Accident	Total	Outcome
T3	All pro-nuclear authoritative sources	22	82	104	The Chi-square statistic is 0.5414. The *p* value is 0.461836. This result is *not* significant at $p < 0.05$ The null hypothesis cannot be rejected since variables are independent.
	All anti-nuclear authoritative sources	4	23	27	
	Total of samples	26	105	131	

6.17 Comparing South African nuclear power to that of other countries

This section compares the current South African position on nuclear technology to the international countries' framework. Following a brief literature review, it appears that several countries have phased out nuclear power, or are in the process of

shutdown and decommissioning their nuclear installations. Some countries, even without nuclear power facilities, are strongly opposed to nuclear energy. Sweden abandoned nuclear power in 1980 after the nuclear disaster of Three Mile Island in 1979. However, in 2010, the Swedish parliament rescinded this decision (Sweden, 2014). A year after the runaway Chernobyl nuclear accident of 1986, Italy decided to move away from nuclear power technology too after a national referendum, re-done in 2011 (Zampano and Zevi, 2011). Germany (Blackmore, 2013:44-87) and Switzerland (Samsinger, 2012) have decided to close all nuclear power facilities after 2023, a decision that was strongly triggered by the Fukushima Daiichi accident and by continual anti-nuclear protests. Japan is also set to decommission all their nuclear facilities by 2023 (City Press, 2011). Spain and Austria have enacted laws to cease construction of all nuclear power plants in future.

As of November 2011, the following countries have taken an irrevocable singular stance against nuclear power, even though they do not have any nuclear power plant facilities in their midst: Australia, Austria, Denmark, Greece, Ireland, Israel, Italy, Latvia, Liechtenstein, Luxembourg, Malaysia, Malta, New Zealand, Norway and Portugal,. However, according to the International Atomic Energy Agency (IAEA), about 59 countries have approached the agency to request some assistance with infrastructure development, skill and technology support on how to enable them to construct their new nuclear facilities (IAEA, 2012).

The most important question now is where South Africa fits in between the two contesting nuclear themes. No national survey has ever been conducted about the prospects of nuclear power in South Africa to date. Views expressed in this report are therefore of interested and concerned parties that took a position with regard to the use of nuclear power technology. Authoritative sources - made up of organisations such as Necsa, NNR, Eskom, Niasa, PBMR, government ministries and departments, nuclear scientists, etc. - are in full support of nuclear power technology in South Africa, as is reflected by the results presented in Table 5.2.From this Table 5.2 in Chapter 5, about 637 direct and indirect quotations were presented in 156 articles, which amounts to 408%.

The articles examined in this study highlight that South Africa may not abandon nuclear power solely based on other countries' decisions after the nuclear catastrophe in Japan. According to some news media coverage of the issue, South Africa's nuclear specialists believe that nuclear energy has a bright prospect and that rejecting nuclear technology outright is unreasonable (Kemm, *et al,* 2015). After the catastrophe at Fukushima Daiichi some reports compare the circumstances that led to the accident in Japan to those present in South Africa. The essence of these arguments, as highlighted in multiple media stories, was that Japan is susceptible to earthquakes and natural disasters while South Africa is seismically stable (Olivier, 2014). Based on these reports, it may be concluded that events at the power plant in Fukushima Daiichi should not influence the future of nuclear energy in South Africa. However, the nuclear accident at Fukushima has made South Africa reassess its safety margins, processes and operational make-up for improvement (NNR, 2012).

In the *City Press* newspaper the deputy president, Kgalema Motlanthe, explained that nuclear technology is the best solution for South Africa's energy future needs (City Press, 2013). Interestingly, countries that are currently phasing out nuclear technology are set to spend over four times more to develop the infrastructure for renewable energy sources. Germany is facing rapidly climbing energy costs after its decision to phase out nuclear technology by 2023, following the Fukushima Daiichi disaster. Meanwhile, Germany's neighbour France is building and consolidating their nuclear power infrastructure (Ogorodnev, 2012). It would be ironic if Germany were to depend on European countries such as France to import energy generated from the use of nuclear technology. Currently, France imports energy from Germany, although France remains the biggest exporter of energy to neighbouring countries (Faull, 2014).

A hasty verdict about nuclear energy when South Africa is compared to other countries reflects a prominent theme in the framing of the nuclear debate in the articles examined in this research. South Africa intends to pursue nuclear power technology with the aim of providing up to 30% of the total energy to the national electricity grid by 2030 (IRP, 2010). The anti-nuclear pocket groups do not have a strong enough voice to dislodge the pro-nuclear frame from coverage in most media outlets, even though their language has grown progressively more irresponsible as

published in the following newspapers, *Witness* (Dullay, 2014) and *City Press* (City Press, 2012a).

The pro-nuclear and anti-nuclear themes have been compared from 2010 to the current date, as reported in Table 5.3 in Chapter 5. The pro-nuclear themes as compared to anti-nuclear themes are more dominant in conservative newspapers such as *The Sunday Times* (35% vs. 17%) and the *City Press* (30% vs 21%). However, a reverse situation is observed in liberal newspapers such as *Mail and Guardian* (18% vs 21%) and the gap appears most pronounced in the *Witness* newspaper (18% vs 41%). Based on the results summarised in Table 5.3 in Chapter 5, the calculated chi-square is 7.217 for p =0.065 > 0.05 which means the hypothesis needs to be accepted. In other words, there is a strong relationship between pro-nuclear themes and anti-nuclear themes in this study. A p value of 0.065 means that there is a 6.5% probability that any deviation from expected is due to chance only. This is therefore within the range of acceptable deviation.

Table 6.8 compares South Africa to the international nuclear countries and organisations. The overall tone on nuclear power in the South African media coverage is underscored in Table 6.8 based on the Table 4.1 - Frame matrix taken from Semetko and Valkenburg (2000: 100). The international media is evaluated from the viewpoint of how Japan handled the Fukushima Daiichi accident and the aftermath.

Table 6.8: Overall tone as per nuclear respondents in South Africa and Internationally. Table is taken from Giannakopoulos (2013:32).

1. Overall tone: South African nuclear media on nuclear power

A. 1) Obscure ----- (2) Neutral ----- 3) Explanatory/Informative

B. 1) Slow ----- 2) Neutral ----- 3) Fast

C. 1) Inefficient ----- 2) Neutral ----- 3) Efficient

D. 1) Unprepared ----- 2) Neutral ----- 3) Prepared

E. Unreliable ----- 2) Neutral ----- 3) Reliable

2. Overall tone: International media on nuclear power

A. 1) Obscure ----- (2) Neutral ----- 3) Explanatory/Informative

B. 1) Slow ----- 2) Neutral ----- 3) Fast

C. 1) Inefficient ----- 2) Neutral ----- 3) Efficient

D. 1) Unprepared ----- 2) Neutral ----- 3) Prepared

E. 1) Unreliable ----- 2) Neutral ----- 3) Reliable

3. Overall tone: International Atomic Energy Agency (IAEA)

A. 1) Obscure ----- (2) Neutral ----- 3) Explanatory/Informative

B. 1) Slow ----- 2) Neutral ----- 3) Fast

C. 1) Inefficient ----- 2) Neutral ----- 3) Efficient

D. 1) Unprepared ----- 2) Neutral ----- 3) Prepared

E. 1) Unreliable ----- 2) Neutral ----- 3) Reliable

6.18 Limitations

It is acknowledged that there might have been numerous limitations that could compromise the quality of this research work as the coding packages were undertaken only by the author of this report, based on information presented in the Frame matrix of Semetko and Valkenburg (2000: 100) and the coding sheet attached in Appendix B. It is clear that at least three coders are needed in case of disagreements or subjectivity. A third coder would then be used as an arbitrator (Perko *et al,* 2011; Gamson and Modigliani, 1989:1-37). It follows therefore that this research work is restricted by the author's own predispositions. Secondly, a limited sample was used for this study. Only four newspapers were examined from a large South African media population. It would have been ideal to examine a wider newspaper sample to get better insight into the nuclear discourse in South Africa. Most of the newspaper articles were carefully selected around the Fukushima Daiichi nuclear accident. The study was only extended to current date in order to investigate the emergence of nuclear trending, if any. Another conspicuous limitation is that the results cannot be applied to other modes of social media such as Twitter, Facebook, blogs, and so on. These social media sources are not aligned to traditional and conventional norms and standards prevalent in newspapers.

The author of this report is fully aware that the first batches of newspapers published immediately after the Fukushima Daiichi accident may not be the most accurate and reliable, but nonetheless these articles were profiled in the same way as articles published long after the accident. The latter articles provided more accurate accounts of the accident. This means that the sample of newspaper articles used might be skewed towards some inaccurate reporting.

6.19 Conclusion

The results of the study were presented in this chapter. The main findings indicate that the pro-nuclear voice overshadows the anti-nuclear themes which attempt to expose the shortfalls of the pro-nuclear position, as they see it. The results also show the subtle tendency of conservative newspapers towards the pro-nuclear themes, based solely on the articles examined. The so-called liberal newspapers mostly carry the anti-nuclear articles. These include *Mail and Guardian* and the *Witness*

newspapers. Interestingly, after the Fukushima Daiichi nuclear accident, there is a paradigm shift by the pro-nuclear sources moving towards neutral themes by frequently reporting on issues such as nuclear safety, maintenance, nuclear expansion programmes, appointments and technical modifications.

CHAPTER 7

Conclusions and Recommendations

7.1 Introduction

South Africa has been using nuclear power for more than 30 years through the operation of the Koeberg Nuclear Power Station (KNPS) in the Western Cape. No major accident has been reported to date that warranted the evacuation of the local population around the KNPS. Despite widespread acceptance of this technology in the Western Cape, nuclear power has its long-standing critics made up by mostly of viable anti-nuclear non-governmental organisations. The anti-nuclear movement consistently points out the inherent dangers associated with nuclear technology, arguing that these dangers surpass the advantages of nuclear technology by far.

According to the results of this study, the anti-nuclear movement appears to be somewhat hidden from media coverage. Lack of media exposure of the anti-nuclear activities can be attributed, possibly in part, to the overwhelming support that the South African government provides to the nuclear industry with regard to job creation and economic sustainability. However, the disaster at the Fukushima Daiichi nuclear plant in Japan forced the media to provide additional coverage of the anti-nuclear movement. Even though the pro-nuclear voice received as much coverage in the South African media, after the Fukushima Daiichi accident as before the accident, more balanced reporting on scientific and technical debates on nuclear power emerged. A year before the accident, there were only four articles representing both the pro-nuclear and anti-nuclear arguments together. A year after the accident, about twenty articles discussed the merits and demerits of pro-nuclear and anti-nuclear views in each article.

This research report was aimed at investigating the media coverage of nuclear power in South Africa prior to and a year after the nuclear accident at Fukushima Daiichi, through the analysis of articles from four South African media outlets – *Mail and Guardian*, *The Sunday Times, Witness* and the *City Press*. Some key findings emerged from this study. Included amongst the findings is the lack of media coverage

on the critical issues such as effective management of nuclear waste, estimation of costs for the nuclear programme, infrastructure readiness, suitability of the nuclear technology to grow the South African economy. These issues were raised by the anti-nuclear movement. Interestingly, issues raised by the anti-nuclear movement were published mostly in the so-called liberal newspapers such the *Witness* and *Mail and Guardian*. Articles published in *The Sunday Times*, which may be regarded as a traditionally conservative newspaper, did not provide clear solutions to the issue of waste minimisation, cost estimation, procurement processes and so on, prompting the anti-nuclear group to accuse the government of lack of transparency, accountability and immense disrespect of the country's taxpayers. It was, however, acknowledged by the government that nuclear vendors pitch their bids to be in line with how much the government is willing to spend in procuring the nuclear programme, hence a provision of cost ranging between R300 billion and R1 trillion is always touted in newspapers (*City Press,* 2012a).

Beyond the issues pertaining to nuclear waste minimisation and cost overruns, the study revealed some serious internal discontentment and wrangling within the nuclear industry, projecting a negative image of the South African nuclear industry when compared to international nuclear countries (see Table 6.8). In summary, prior to the Fukushima Daiichi accident, the focus of the anti-nuclear movement was mainly on how poor the management of nuclear power in South Africa was, rather than on the actual anti-nuclear positions.

The pro-nuclear themes, according to the study, appear to be the 'official frame', with newspapers engaging this group more. Surprisingly, the pro-nuclear group is mostly made up of government officials rather than experts and professionals in the field of nuclear power. This could cement the old adage that the policy on nuclear power is derived more from political and strategic decisions than technological decisions. The pro-nuclear direct quotes stand at 75% compared to 49% of anti-nuclear ones. Most of the pro-nuclear groups emphasise economic growth, job creation, and so on (see Table 5.2).

The nuclear disaster at Fukushima Daiichi nuclear plant has provoked the pro-nuclear and anti-nuclear groups to redefine their discourses in an effort to respond to

the challenges and questions which were raised after the accident in Japan. There was a paradigm shift displayed by both the pro-nuclear and anti-nuclear activists. The focus by the anti-nuclear movement shifted to exposing the inability of the South African nuclear industry to guarantee the safety of the people and the environment, while the pro-nuclear themes were focused on important lessons that the nuclear industry needs to learn from the Fukushima accident and to incorporate these lessons in future nuclear expansion programmes. Due to the sustained prominence of pro-nuclear articles published in the four newspapers after the Fukushima accident, it may be concluded that the media looked more at official frames for reliable information rather than the narratives provided by activists, especially when controversial scientific and technical issues were part of the argument.

The research work also revealed how the media shape and control the dissemination of critical information to the public, and how this information is used to influence public perception. This is in line with the work of various authors such as Gamson and Modigliani (1989:1-37). It is interesting to note that views of neither private citizens nor nuclear workers were solicited on both the *Witness* and *City Press* newspapers since 11th March 2010 to 15 April 2015 (see Table 5.2). This could mean that the general views of the South African public would not have a profound impact on the political decision about a nuclear expansion programme in future. In short, these research findings indicate that the media in South Africa, as per the four newspapers analysed, deploy framing to control, direct and propagate selective messages to inform the general public about critical issues of nuclear power technology.

As a point of caution, this conclusion should be understood in the context that when it comes to reporting scientific and complex technical issues, the public cannot interpret on its own some information from scientific sources, thus it is important for the media to take an active but impartial role in getting experts to interpret the information in an understandable way for the benefit of the public.

The study has unearthed the fact that discourse and public opinion on nuclear power in South Africa, prior to and after the Fukushima nuclear disaster of 2011, is

effectively shaped and controlled by the media through the use of so-called media framing.

7.2 Recommendations

It would be interesting to extend this research work to include interviews and the completion of questionnaires by those involved in the nuclear industry. This would assist in understanding which voices are missing or not well-articulated in the South African media discourse on nuclear power. Relationship between public views, perceptions and interpretations on the issues against media frames has been long established (Gamson and Modigliani, 1989:1-37), but it is still unclear the extent to which the public views can influence the media or vice-versa. The critical questions that need to be answered out of this relationship are: Is the media providing a true reflection of public opinion and perception? Or do the media deliberately create public opinion to serve their own interest? The point in hand is the natural disaster that occurred in Japan, caused by a massive earthquake followed by a tsunami, and the subsequent damage that resulted from this accident. now being imperceptibly blamed on as having been caused by an accident at the Fukushima Daiichi nuclear plant. Currently, when reference is made to Fukushima Daiichi, people think of a nuclear accident and not the devastation caused by a tsunami and earthquake.

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APPENDIX A

List of newspapers examined in this research report

City Press newspaper

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APPENDIX B

Table B. 1: Coding sheet used to extract information from media

Definition / Item	Comment
Newspaper Source (tick)	
Mail and Guardian ☐ *The Sunday Times* ☐ *City Press* ☐ *The Witness* ☐	
Author & Date article published	
Overall tone	
Pro-nuclear ☐ Anti-nuclear ☐ Neutral ☐ Both pro & anti-nuclear ☐	
All nuclear statements	
Characteristics of quotation or citation (Tick one or more for positive comments)	
Government politician & designation	
Eskom (including Koeberg Nuclear Power Station)	
Necsa	
PBMR	
NNR	
Private citizen	
Academic / Professional / Specialist	
Business community	
Niasa	
Nuclear worker (including labour union member)	
Number of direct quotes/ citation by all nuclear activists	
Number of indirect quotes/ citation by all nuclear activists	
Other (specify)	
Pro-nuclear statements	
Pro-Nuclear Themes (*check all that apply*):	
Nuclear power means progress	
Jobs & economic security	
Safe	
Clean	
Helps with climate change	

Definition / Item	Comment
Accessible	
Cheap	
Profitable	
Essential for economic growth	
Technological competence available in South Africa	
Transparency of government and nuclear industry	
Number of direct quotes/ citation by pro-nuclear activists	
Number of indirect quotes/ citation by pro-nuclear activists	
Other (specify)	
Anti-nuclear statements	
Characteristics of person(s) being cited / quoted in article	
Government politicians & designation	
Anti-nuclear activists (specify organisation name and position)	
Private Citizen cited (specify proximity to nuclear facility)	
Academic / Professional / Specialist / Expert	
Business community	
Workers (including union)	
Other (Specify)	
Anti-nuclear themes (*check all that apply*):	
Dangerous & unsafe	
Health problems / illness / cancer	
Nuclear reactors are expensive	
Nuclear proliferation, sabotage, terrorism (tick appropriate)	
Lack of transparency and mistrust	
No lessons learned	
Shortage of skilled workforce and aging workforce	
Not suitable for South Africa	
Investment into alternatives such as wind, solar, biomass or gas	
Citing countries stopping nuclear power programs	
Number of direct quotes/ citation by anti-nuclear activists	
Number of indirect quotes/ citation by anti-nuclear activists	

Definition / Item	Comment
Derogatory / strong framing of anti-nuclear activists	
Details of person(s) deploying derogatory frame (source of comments)	
Government politician & designation	
Eskom	
Necsa	
PBMR	
NNR	
Niasa	
Private citizen	
Academic / Professional / Specialist / Expert	
Business community	
Nuclear worker (including unions)	
Other (specify)	
Derogatory Framing of anti-nuclear activists (*may include multiple examples*):	
Irresponsible	
Extremists (e.g.: terrorists, radicals, rebels, enemies)	
Untrustworthy (e.g.: compensated from outside sources)	
Anti-South Africa / unpatriotic	
Distorting the information, even lying	
Exploiting public fear - fear mongering	
Activists exploiting Fukushima Daiichi accident for personal gain	
Other (Specify)	
Illustration of Derogatory Framing:	
Are specific targets of attack (i.e., names) identified? Yes: ☐ No: ☐ Specify who:	
Does article include personal and character assaults of activists? Yes: ☐ No: ☐ If yes, give examples:	