Master Thesis

The Reflection of Foresight in Defence Policy Making: A Comparative Study of the United Kingdom and the United States

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Executive Summary

In today's fast changing security environment, characterised by deep uncertainty and a multitude of threat contingencies, the strategic planning process needs to be more flexible, adaptive and robust. Over the past few decades, the so-called 'foresight methodology' has made its entry into the strategy processes of businesses, policy makers and long term defence planning. This study attempts to examine in what way the discourse of publicly available security and defence related future-oriented studies ('foresights') are reflected in the security priorities as described in the defence policy of the United States (2006 Quadrennial Defense Review) and the United Kingdom (2004 Defence White Paper) respectively. The 'meta-foresight' approach taken in this study offers a strategic perspective and thematic focus, attempts to identify emerging threats and anticipates uncertainties, prevents a narrow focus and tries to provide a long-term context for strategic defence planning.

This study provides an elaborate discussion on foresight, gives more insight on the concept of 'foresight analysis', its development and entry into the strategy process of various domains and the way defence currently anticipates the future security environment. It makes clear that it is imperative to acknowledge deep uncertainty in this process and that in strategic (defence) planning the "FAR-principles" of Flexibility, Adaptability and Robustness have to be upheld. Different insights from the academic literature eventually lead to the normative assumption that the use of foresight analysis should be reflected in the formulation of the defence policy of the U.K. and the U.S.

To assess whether this is actually the case for the British and U.S.' defence policy, a large amount of future-oriented studies ('foresights') in the field of security and defence, focusing on the United Kingdom and United States, was collected. Furthermore, the structure of the defence policy of both the U.K. and U.S. and the thematic security priority areas have been discussed. The research – policy making nexus is an important element in this discussion as well, since it provides more insight on the way research results are used in the policy making process, hence the creation of 'evidence-based policy'. This nexus seems hard to uncover, because the actual interaction process between these two worlds is difficult to determine and could, therefore, not provide for hard evidence.

To analyse the large datasets for both the U.S. as well the U.K. in an efficient, apolitical and unbiased manner, the text mining program 'Text Analyst' was used. Text mining has slowly made its intrusion into the analytical toolbox of strategic planners and is capable of analysing large amounts of unstructured data in a comprehensible and efficient way. For the purposes of this study it provided

an excellent opportunity to use it and offer a new approach in the public policy field. In the filtering phases after the text mining analysis, the data analysis program Tableau Software and several other visualisation methods have been used. It follows that most priority areas covered in the defence policy of both countries are consistent with the outcomes of the foresight discourse. The text mined defence policy documents also seem very coherent with the thematic priority areas as explicitly stated in the defence White Papers, suggesting a 'proof of concept' of the text mining tool.

With regard to the U.S. dataset, all the priority areas of the 2006 Quadrennial Defense Review come back in the text mining results, albeit in different terminology, but with the same content. Themes such as 'Shifting Power Structures' and 'Energy Security' are, however, not part of the priority areas of the 2006 QDR, while they are regarded as very important for the future defence landscape of the U.S. These 2006 QDR priority areas are formulated rather broadly, thus making it difficult to assess whether a more specific security theme falls under one of these broad policy areas. Overall, the U.S. discourse focuses more on the 'hard' issues, i.e. terms like military, army, warfare, terrorism, enemy and weapon, and has significantly higher scores than the U.K. dataset.

With regard to the U.K. dataset, the text mining results also show a considerable overlap with the most important themes expressed in the 2004 Defence White Paper. However, contrary to the 2006 QDR, the British defence policy describes much more specific thematic areas of importance – the so-called Strategic Trends. This made the comparison effort somewhat easier, because the text mining results were also rather specific. Nonetheless, some themes are not touched upon or just barely mentioned in the 2004 White Paper, such as 'Energy Security', 'Nature & Environment' and 'Health Issues', while these are seen as very important future issues for U.K. defence. Overall, the U.K. discourse focuses more on the 'soft' issues, i.e. terms like energy, environment, health, emission and greenhouse has significantly higher scores compared to the U.S. dataset.

In this study several recommendations are made concerning the potential of text mining applications for data analysis, a more thorough analysis of the actual use of foresight analysis in today's defence policy formulation and the need for further research on the basic interaction process between the research community and policy world in the defence domain. Together, these recommendations aim to improve the establishment of good strategic foresight processes in defence policy making. The various foresight programs in the public and private sector can provide important insights, but also the way 'the art of the long view' can be brought into the policy process. This should lead to more flexible, adaptive and robust strategic defence planning, which is imperative in today's fast changing, highly uncertain security environment.

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Chapter 1: Introduction

As an introduction to the Master thesis in the field of international public management and public policy, this chapter serves as a starting point in the thesis process and gives an initial idea what to expect. It entails the conceptual framework and research strategy. In the conceptual framework there will be given insight on the project design, i.e. research motive and objective in section 1.1. Subsequently, a formulation of the objective and the main research question of the thesis along with the sub questions will follow in 1.2. In the process- and research model the focus will be on the structure and format of the research and is covered in 1.3. An impression of the theoretical framework will be given in 1.4. Finally, with regard to the research strategy, the attention will be on pointing out the research material and the operating strategy in 1.5. This item suggests which resources and activities will form the basis for conducting the research, a discussion of the research methods and how to avoid pitfalls.

1.1 Project design: Research motive and objective study

Research motive

In 2007, a task group appointed by the Dutch Ministry of the Interior initiated Project National Security, as part of the wider program "Strategy National Security". As a partner in this consortium, the think tank *The Hague Centre for Strategic Studies (HCSS)* tasked itself to conduct a meta-analysis of hundreds of foresight exercises on various topics. The idea behind this was to identify – and subsequently prioritise - future relevant themes that can have an impact on the vital interests of National Security. These so-called strategic explorations – as a part of the government-wide analysis – are aimed at identifying themes and developments that could either offer opportunities for or pose a threat to National Security in the long term. The outcomes are currently studied further in-depth as a part of the government-wide analysis of the various themes over the medium term.

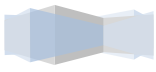
The rationale behind this approach is that the meta-analysis of foresight exercises should yield a list of issues which are generated on the basis of a much larger pool of experts, modelling techniques and sectoral and cultural perspectives than is the case in regular individual foresight exercises. The same approach will be taken in this research. The *societal relevancy* of the research lies in the idea that a large pool of future-oriented studies, or 'foresight' exercises, in the field of security and defence, is analysed in order to distil and prioritise relevant security themes that should be

incorporated in long term strategic defence planning. Moreover, with this approach it is possible to overcome some of the stovepipes that exist in the predictions of a majority of the foresight exercises as they often focus on a specific field. The advantages of this approach are the following (National Security Strategy, 2007):

- Offering a strategic perspective and vision/ issue focus: developing a broadly supported vision of the long term and the relevant insecurities can help get to grips with issues and developments from a more content-based perspective without any unwanted interference from present day concerns and interests;
- Identifying any newly emerging threats and opportunities;
- Anticipating uncertainties: concepts or situations that may be regarded as permanent in the short term may be subject to fundamental or structural changes (such as the way in which the economy functions, geopolitical power shifts, etc). Anticipating the potential for change on the long term influences political decisions that can be made today (or not, as the case may be);
- Preventing mono focus;
- Providing a long-term context for strategic planning: making sure that strategic plans are robust against a much wider range of the scenario space, something Davis *et al.* (2002) calls "*the degree of FARness"* (**F**lexible, **A**daptive and **R**obust strategies). If we can estimate that certain short term threats will become more or less prominent in future, or become intertwined with other threats, this can affect the choices we make in terms of the applicability, intensity and durability of the instruments we are developing in the present.

In the case of the National Security Strategy, this approach makes it possible to take a more 'evidence-based' stand in security policy to present to the Dutch government. In the follow-up, risk assessments and capability based planning take place. As mentioned, the same logic is applicable in the case of developing a sound defence policy.

The *scientific relevancy* of the research lies in the idea that through a meta-analysis of already existing studies a long term context can be provided in order to improve defence policy. Hopefully, the results of this exercise can be used – albeit on a modest scale – to give a more solid foundation to the theoretical concepts of the research issue. In addition to generating relevant issues, a text mining software program called Text Analyst makes it possible to determine what other issues are mentioned across the different exercises in relationship to the relevant issues. Subsequently, the



results are compared with the priority areas identified in the defence policy of respectively the U.K. (2004 Defence White Paper) and the U.S. (2006 Quadrennial Defence Review). Logically, these MoD policy documents and the long term strategic force planning documents are also text mined to check whether it corresponds with each other. Hence, rather than being of a mono- or a multi-disciplinary nature, the meta-foresight exercise thus provides for a true interdisciplinary approach.

Objective

The objective for this research is to analyse and compare to what extent the foresight discourse of relevant themes in the field of security and defence is reflected in the actual defence policies of the United Kingdom and the United States (henceforth respectively U.K. and U.S.). It is possible that there is a significant overlap between the content of foresight studies and the defence policy, perhaps suggesting that foresight 'drives' the formulation process of the defence policy. However, it also possible that it works the other way around: priorities in the defence policy 'drive' the foresight discourse. A third option is that certain, more formal schools of thought about defence planning form the basis and have an influence on both the nature and direction of foresight studies and the formulation of defence policy. The focus of this study is on the first option, i.e. the priority areas in the defence policies are to some extent driven by the topics covered in foresight studies and *not* vice versa. Therefore, it should be noted that the topics of the foresight studies used are regarded as 'given' and no further attempt is made to get more insight on the influential factors that drove the choice for the nature and direction of these topics.

The main rationale behind the exercise is to describe how the foresight methodology can be used in theory to serve as input for policy makers; in what policy domains this methodology has penetrated over time; and how this works out in practice in the case of the U.K. and U.S. defence policies. Thus, the way in which the input of foresight exercises is contrasted with actual long term defence policy making. Subsequently, the outcomes are linked to the theoretical framework. For this purpose, a large set of foresight studies in the field of security and defence (focussing on the U.K. and U.S.) will be compared. In the follow up of the rather quantitative output and main conclusions, it becomes clearer what evidence we have that foresight leads to indiscernible strategic choices. This should lead to recommendations for defence policy makers on better ways to cope with long term strategic planning and the role foresight can play in this.

The choice for the U.K. and U.S. is based on a preliminary investigation of the currently available foresight exercises in the field of defence, which is quite extensive. This might also indicate that the use of foresight analysis may already be incorporated in their existing structures for policy making.

Besides, foresight analysis is only truly done in big countries as the U.K. and U.S. and there is more information publicly available. Also, my current activities at HCSS are in line with a research topic that includes the U.K. and U.S.

1.2 Main research question and sub questions

From the objective as described above, the main research question can be formulated as follows:

"In what way is the discourse of publicly available security and defence related foresight studies reflected in the security priorities as described in the U.S. and U.K. defence policies?"

This type of research question can be classified as 'evaluative' in the term used by Verschuren and Doorewaard (1999). According to these authors, in the evaluation stage the intervention already took place, but that stakeholders do have expectations about the results. In this case, it needs to be examined to what extent the foresight discourse is reflected in the formulation of the defence policy by both the U.S. and U.K., why this is (not) the case and what the consequences are. Therefore, this thesis can be regarded as an evaluative research project.

Sub questions

In order to come to a structured conclusion that meets the objective of the research, some sub questions are formulated that need to be answered on the basis of the obtained dataset and conducted analyses, which eventually leads to the answering of the main research question. Figure 1.1 shows this process in a model. Out of the main research question several important sub questions can be derived, which are:

(i) *"What are distinct features of foresight analysis?"*

(ii) *"To what extent is foresight anchored in strategic policy making?"*

(iii) *"What are the main trends in the development of the defence policy of the U.K. and U.S.?"*

(iv) *"What are the current focus points in the U.K. and U.S. defence policy and the similarities and differences between them?"*

(v) *"What is the role of foresight in defence policy making in the U.S. and U.K.?"*

(vi) *"How can a prioritisation be made of the relevant themes and opportunities/threats for defence policy making?"*

(vii) *"In what way does foresight lead to indiscernible strategic choices for long term defence planning?"*

The purpose is to use these sub questions as stepping stones throughout the chapters, rather than providing definitive answers for each of them. In section 1.5, the research strategy and ways to avoid possible pitfalls when answering these questions are described.

1.3 Process- and research model

In figure 1.1 below, the process- and research model is shown. The process started with a thorough desk research, focusing on the development of U.K. and U.S. defence policy making, the literature on 'foresight analysis', in particular its role in policy making and a search for innovative methods to analyse vast amounts of data. Subsequently, this information yields a deeper understanding of 'foresight analysis' as such. Consequently, the findings of this in-depth literature research will be examined in order to find out what the implications for long term strategic (defence) planning might be. Also, the data set of so-called foresight studies will be analysed by using a new, innovative instrument – text mining – that is rather unfamiliar in the 'policy world'. The analytical part will result in a prioritisation of important themes that (should) play a role in defence policy making. Using the analytical framework and the text mining results of the foresight discourse, an attempt is made to answer the main research question.

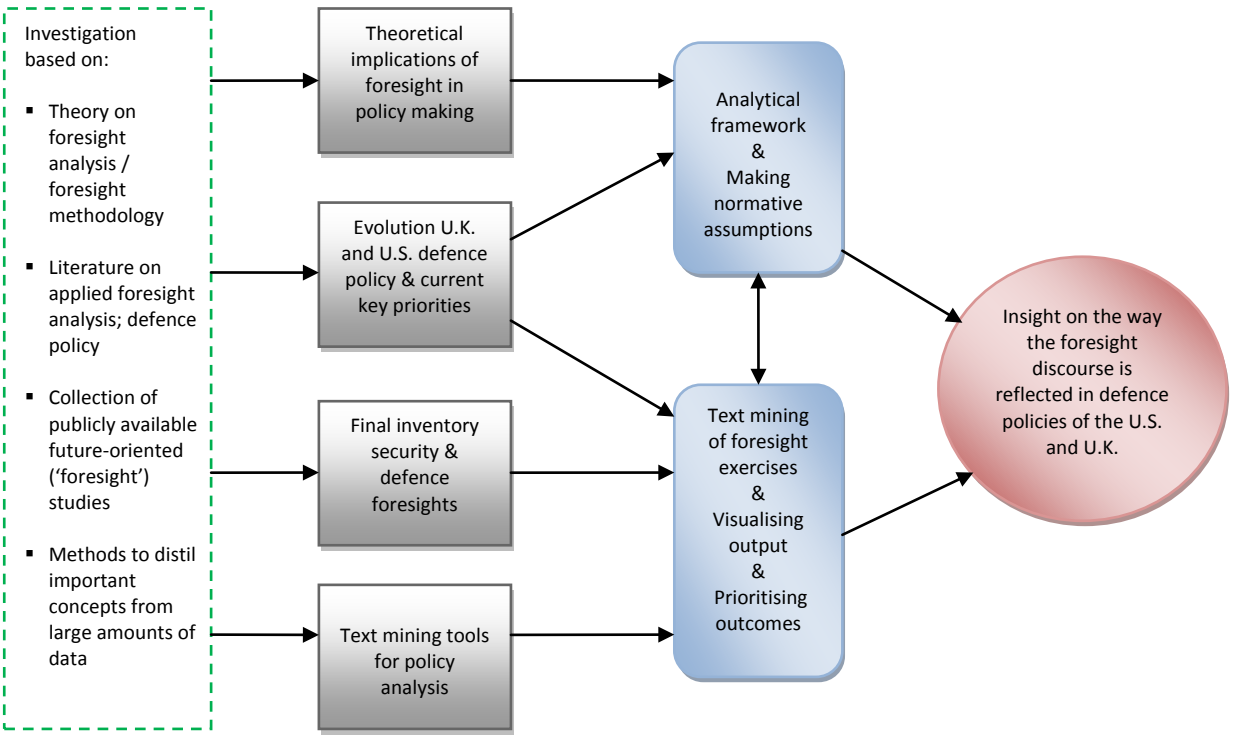


Figure 1.1: The process- and research model

1.4 Impression theoretical framework

In this section an impression of the theoretical framework of this study will be given. First, attention is paid to the concept of 'foresight', the foresight methodology and its relation to other future research methods, such as 'forecasting'. Second, the implications of the foresight methodology for policy making will be discussed. Insight will be given on the role that foresight analysis can play in theory and how the use of it in policy making has developed. Third, the focus lies on defence policy making, in particular the move from so-called "point scenarios" to capability-based planning and foresight analysis in defence planning. Finally, the use of research for policy making will be discussed.

Foresight, isn't that...?

The foresight approach characteristically seeks the potential drivers of change relative to a simple inference about a particular future situation based on known facts (Botterman *et al.*, 2004). Because the future is inherently uncertain and multidimensional, planning based on such an extrapolation, or on any one or a few notions about the future, will not do the job (Davis, 2001; Lempert, Popper, and Bankes, 2003). The drivers of change are rarely fully controllable. The changes to be understood may be almost continuous, each so small as to be barely perceived, or they may be discrete events. "*They may be natural, purposive, or by-products of other purposes*" (Davis, 2003).

Foresight is a multi-facetted concept that has become a useful tool to support decision-making, especially in government policy, but also increasingly in the business environment. The foresight methodology stresses the interactive and participatory nature of dealing with long-term future challenges, thus recognizing the complexity and distributed character of innovation processes. Over the past fifteen years, foresight has become a common practice at national, regional and sectoral level to inform and underpin decision-making with repercussions on collective concerns. As such it has been used to create a shared understanding of future challenges among stakeholder groups, to generate joint visions of the future, and to devise policy options.

Foresight analysis in policy making

The use of foresight analysis in policy making is progressing in many countries. For example, late 1990s the U.K. government had set up a special *Foresight Competency* with the aim "*to improve the relative performance of U.K. science and engineering and its use by government and society"* (www.foresight.gov.uk/About_Foresight/index.html, 2008). To achieve this, the *Foresight Competency* identifies potential opportunities for the economy or society from new science and technologies, or considers how future science and technologies could address key future challenges

for society. Results from this analysis are then supported by the so-called *Horizon Scanning Centre*, whose aims are "*to inform decision-making both within government departments and across departments; to support horizon scanning being carried out by others inside and outside government; and, spot the implications of emerging science and technology and enable others to act on them"* (www.foresight.gov.uk/horizon_scanning_centre/index.html, 2008). In the years since the United Kingdom's original exercise, foresight efforts have become relatively common in Europe and Asia. However, many of these exercises have adopted a substantially broader focus. In addition to technology, foresight now also touches on social, economic, and even political issues to gain insight into trends across a broad cross section of a country's public life (Lempert, Popper, and Bankes, 2003).

Foresight analysis in defence planning

Although the development of foresight methods first occurred in non-military applications, the central ideas are part of an ongoing interaction between military and non-military thinking. In today's defence planning, the uncertainty issue arises at the highest level as people argue about whether China will become a troublemaking regional power, what the consequences are that Russia is reverting to a more nationalist course, and whether Iran will actually develop a nuclear bomb. Some raise questions about what the future will bring with respect to Weapons of Mass Destruction (WMD), threats to homeland security, or different types of conflict such as wars against non-state terrorist groups or drug lords.

With regard to 'defence', historically there has been a long tradition in long-term planning in which an 'old paradigm' of so-called 'point-scenarios' were worked out in order to further develop capacities and strategies. According to Davis (2002), point scenario planning fixates on *"particular enemies, particular wars, and particular assumptions about those wars – a fixation that comes at the expense of more flexible and adaptive planning."* As the same author explains, the often cited obstacles of this approach include *"organizational inertia, 'stove-piped' management, services oriented processes and the presence of a decentralised power structure"* (Davis, 2002).

So in recent years strategic planning has evolved towards a broader set of central coordinated scenarios that are used for more diverse purposes, such as capabilities-based planning and exercising. High-level policymakers have become increasingly aware of the importance of adaptability. The concept of capabilities-based planning is now moving rapidly from idea to practice. The 2001 Quadrennial Defense Review announced a new defense strategy based upon a *"capabilities-based approach to defense"* (QDR, 2001), or as Planeaux (2003) describes *"the QDR*

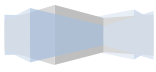
emphasized the need to shift the basis of defense planning from a 'threat-based' model that has dominated thinking in the past to a 'capabilities-based' model for the future". Another example is the U.K., where a group named the Studies Assumptions Group (SAG) conducted over 40 'settings' representing the full spectrum of operations that U.K. Defence might conduct (Capability Management Handbook MoD, 2007). This approach allows MoD to express the risk being taken in particular areas and to balance its structures to minimise that risk. They do this in a manner that gives a clear auditable path from present day activities to potential future ones. In the same vein, the U.S. also conducted a new set of planning scenarios in pursuance of the recent Quadrennial Defense Review (2006 QDR). Due to global and national security environment changes and deep uncertainty, the corresponding changes in the analysis activity to support defence and security planning lead to a more comprehensive approach of foresight analysis based on drivers and so-called 'wild-cards'.

Use of research in policy making

Research can provide a background of (empirical) data and ideas that affect the problem solving thinking of policy makers. As Weiss (1982) described, research can "*influence the conceptualization of the issues with which policy makers deal; affect those facets of the issue they consider inevitable and unchangeable and those they perceive as amenable to policy action; widens the range of options that they consider; and challenges some taken-for-granted assumptions about appropriate goals and appropriate activities.*" Sometimes it makes policy makers aware of the over-optimistic goals they set as opposed the actual (meagre) program resources. However, a well known concern among social scientists is to what extent their research is actually used as input for public policy makers. As Weiss (1979) describes, there is mutual interest in whether social science research is actually 'used' in order to influence policy makers. In clarifying the concept of 'research utilization', she discusses several different meanings associated with the concept. However, none of them provides a satisfactory answer to how research resources can be best mobilised for policy making. Regardless of which meaning, social science and policy interact, as Weiss concludes, *"influencing each other and being influenced by the larger fashions of social thought"* (Weiss, 1979).

1.5 Research strategy and research material

In this section, the choice for a research approach and the kind of material required in order to operationalise the key concepts of the research objective is considered. At this stage the thoughts and ideas need to be converted into concrete actions, hence from theory into empirical reality. In the research strategy, the set of decisions about the way in which the project will be carried out is



discussed. In particular, relevant material and processing this into answers to the research questions are of major importance. Therefore, the methods of inquiry, research material and pitfalls are discussed.

Methods of inquiry

In Verschuren and Doorewaard (1999), several research methods are passed in review. They discuss several key decisions each researcher has to make to find out which kind of method, or blend of several methods, suits his/her type of research best. Roughly there are three choices one should make: the choice between breadth or depth, quantitative or qualitative, empirical or more theoretical. In practice, one method does not have to exclude another of course, and a blend of one or more strategies is usually the case. Looking at the objective of this study, the research strategy has the characteristics of a desk research, combined with some elements of the grounded theory approach (Verschuren and Doorewaard, 1999).

Desk research is the most obvious choice because existing material is used, there is no direct contact with the research object and the material will be looked at from a different perspective than at the time of its production. The latter is called a secondary research strategy since existing data is rearranged and analysed from a somewhat different perspective. The collected foresight studies are reliable scientific data, because they meet the scientific requirements and are published by recognised research institutions. Furthermore, desk research has the advantage that the data can be quickly gathered. A disadvantage can be that the material used has originally been gathered for other purposes than intended in this research. Of course the required 'relevancy' of the data can be determined by the researcher himself, but even then there have to be settled with a *biased* perspective of the material. This drawback is likely to be avoided by the text mining tool, which is capable of distilling the most important concepts from a text in an *unbiased* manner.

Next to the desk research approach, this study also has some characteristics of the grounded theory approach (Verschuren and Doorewaard, 1999). In particular, the use of a text mining tool is rather new in the field of policy studies. The combination with foresight analysis in defence policy is not well researched so far and has the potential to provide a valuable contribution to policy science. The chosen research objective in combination with a continuous process of comparing empirical data and theoretical data and a hermeneutical attitude allows for potential new theoretical venues. The grounded theory approach is therefore suitable if a theory is to be developed in an area that has hardly been studied. Especially the 'meta foresight' approach can result in developing innovative practical theories rather than abstract general theories. Hopefully, the use of the procedures and

techniques of the grounded theory approach can add to a further elaboration of the research issue in a scientific way.

Research material

In order to answer the sub questions and main research question, the input for this arises from the dataset that will be obtained from the analytical framework and the text mining output. As mentioned, this should contain a literature review on foresight for strategic planning in general and for defence planning in particular; stipulating which drivers/factors have an impact on defence issues; prioritisation of these drivers/factors in themes; and coupling between theory and practice by analysing actual long term defence policy making. Core of this approach is not to carry out a separate exploration, but using many foresights exercises which have been carried out by foresight institutes, governments, think tanks and other organisations involved in foresight studies. This gives the possibility (among other things) of broadening the perspective and processing large amounts of results.

In order to distil important themes out of a large population of foresight exercises, a text mining tool can be used that has the capability to identify the most important terms in a study (in an unbiased manner). These terms can then be clustered in several thesauri. For this purpose, the initial plan is to use a software competency called “Text Analyst”. Mathematical algorithms inside Text Analyst determine which terms and term combinations – concepts – are most important in the pool of foresight exercises by analysing their connections to other concepts in that text. Each concept is then assigned a semantic weight on a scale 1 – 100 as well as the semantic strength of a relationship with other concepts. Subsequently, the results are compared with the text mined results of the MoD policy papers and the long term strategic force planning documents to check whether it corresponds with each other (for both the U.K. and U.S.). This is visualised in figure 1.2. For example, concept Z is concerned with “terrorism” and is therefore seen as an important concept within the foresight exercises (semantic weight of 95) as well as in the policy documents of the U.S. and U.K. However, it is beyond the scope of this phase of the research to go in-depth on the technical details of the text mining application, so this will return later.

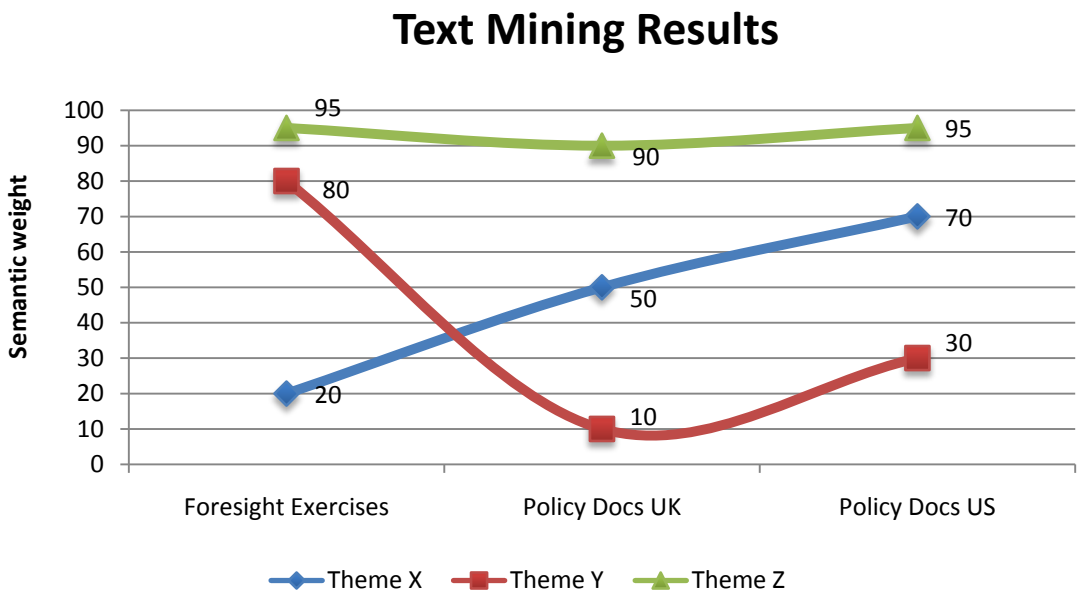


Figure 1.2: Correspondence in text mining results

Below an overview is given of possible strategies for obtaining the required information. For the sub questions the strategy is as follows:

Sub question		
"What are distinct features of foresight analysis?"		
Sources	**Data**	**How**
Literature on foresight (Botterman; Cuhls; Lempert, Popper, Bankes; etc.); literature on research-policy bridge (Weiss et al.)	Contrasting characteristics of foresights as opposed to, for example, forecasting or Delphi; theory on the role and use of foresight analysis for public policy	Qualitative content analysis
Sub question		
"What are the main trends in the development of the defence policy of the U.S. and U.K.?" *"What is the role of foresight in defence policy making in the U.S. and U.K.?"*		
Sources	**Data**	**How**
MoD U.K. and U.S.; journals on defence issues / warfare; literature from Davis; Popper; Gompert etc.	Defence policies of last administrations; articles on defence policy U.K. / U.S.; focus away from 'point scenarios' to CBP and long term strategic planning	Qualitative analysis

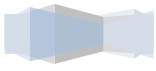
Sub question		
"What are the main trends in the development of the defence policy of the U.S. and U.K.?" *"What is the role of foresight in defence policy making in the U.S. and U.K.?"*		
Sources	**Data**	**How**
MoD U.K. and U.S.; journals on defence issues / warfare; literature from Davis; Popper; Gompert etc.	Defence policies of last administrations; articles on defence policy U.K. / U.S.; focus away from 'point scenarios' to CBP and long term strategic planning	Qualitative analysis
Sub question		
"How can a prioritisation be made of the relevant themes and opportunities/threats for defence policy making?"		
Sources	**Data**	**How**
Study centre(s) aimed at military & defence issues	Future warfare studies / defence foresights and categorize them according to time horizon, main subject	Quantitative analysis
Testing of text mining tool	Foresight exercises specifically focussed on defence issues (see above)	Software competency

Table 1.1: Research strategy

Pitfalls

Although this research proposal forms the basis of the actual thesis, it is of course possible that in the iterative process of the research several problems can emerge, that cannot be totally ruled out at this moment. A matter of fact, some just cannot be foreseen until the moment you run into them. Nonetheless, it is quite useful to make some predictions about possible pitfalls that need to account for. Based on a preliminary investigation these pitfalls will not occur in finding the qualitative information as described in Table 1.1, i.e. information about defence policies in the U.S. and U.K. and foresight literature. This is all well-documented, quite extensive and available in open source. The same accounts for the foresight exercises related to defence issues, which can be found in several foresight databases and military internet sites.

The main pitfall is probably the use of a text mining tool. Although this method of analysis is not very new as a business intelligence tool, for policy analysis it is. The natural language processing technique



and analytical capability are to some extent still a ‘black box’. There is constant interaction with the Russian software designers to optimise the tool and give feedback on the processing technique. The results of this application in other projects at HCSS look promising and indeed delivered reliable results. Nonetheless, if this tool somehow fails to deliver reliable output, e.g. due to an incomplete dictionary about a specific topic or crippled cluster analyses of concepts, the exercises need to be analysed manually. Consequences of this is that it then becomes very time-consuming and the pitfall of a ‘researcher-bias’ in determining what is important. Another pitfall might be the desk research approach, of which a consequence is that the formulation of the research objective and research issue depends on whether the material needed can be found in the sources available. To cope with this, a very large amount of foresight exercises is needed so that also the small-scale - but potentially relevant - studies become part of the database and are not overlooked. However, a first impression of the available data indicates that this problem has only a small chance to cause a reformulation of the research objective.

Chapter 2: Foresight Analysis

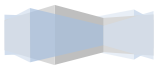
2.1 Introduction

Thinking about the future and future events has a long history and was the basis for the 'success' of the Greek oracles in ancient times (Parke, 1956), when forecasting the future was less predicting than making politics and shaping present-day decisions (Cuhls *et al*., 2002). A famous example of a futurist is Michel de Nostredame, or "Nostradamus", a Renaissance apothecary who made a profitable sideline of prophecy (Forbes, 2007). However, the fact remains that the future is unpredictable and policy makers should not merely rely on such charlatans. Nevertheless, some developments can be foreseen and alternatives can be thought of. Therefore, the possibility of preparing for the future (with limitations) or try to shape it actively forms the background of "foresight". The essence of what are coming to be called foresight methods (Botterman *et al.*, 2004) is therefore identifying the major dimensions of the future that may influence the world and for which establishing the right courses of action at the right time may make a difference.

In this chapter, insight will be given in the concept of 'foresight analysis'. In section 2.2 the search for a definition, its origin and its objectives are discussed. In section 2.3, the place of foresight in the wide and complex world of future research methods is the centre of attention. Various methods are briefly discussed and their role as part of or distinction from foresight will be explained. In section 2.4, the critique on foresight as a tool for policy making is described. In section 2.5, the focus will be on the role of foresight in policy making, in particular strategic foresight and how it has penetrated in U.K. and U.S. policy making. Section 2.6 will then discuss the use of foresight in defence planning, thereby paying attention to 'point scenarios', FARness, adaptiveness and the so-called XLRM framework. In section 2.7, the role of foresight in strategic planning within the business environment is described. Finally, a conclusion about the concept of foresight and its meaning for policy making, defence planning and strategic planning will be drawn in section 2.8.

2.2 "Foresight" explained

Foresight is a way of thinking about planning for the future that has the potential to strengthen the strategic dimension of management and policy making. It has a participatory nature in the creation of shared long term visions as input for present decision making processes. Foresight analysis is used by policy professionals in all kinds of sectors (industry, government, research) at various territorial scales (global, national, the region or municipality), but also at the level of the research system and



that of the supply chain or production system (EFMN, 2007). Joseph Coates (1985) formulated the following, rather broad, definition of foresight:

> *"Foresight is the overall process of creating an understanding and appreciation of information generated by looking ahead. Foresight includes qualitative and quantitative means for monitoring clues and indicators of evolving trends and developments and is best and most useful when directly linked to the analysis of policy implications. Foresight prepares us to meet the needs and opportunities of the future. Foresight in government cannot define policy, but it can help condition policies to be more appropriate, more flexible, and more robust in their implementation, as times and circumstances change. Foresight is, therefore, closely tied to planning. It is not planning—merely a step in planning."*

Another commonly used definition of foresight appears in an often cited paper of Cuhls (2003), where the 'classical' definition of foresight of Ben Martin (1995, 1996) is formulated as follows:

> *"Foresight is the process involved in systematically attempting to look into the longer-term future of science, technology, the economy and society with the aim of identifying the areas of strategic research and the emerging of generic technologies likely to yield the greatest economic and social benefits.*"

However, probably the most useful definition is given by the *European Commission Handbook on Foresight* (2002), which also points out to the integrative, networking character of foresight:

> *"Foresight can be defined as a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilizing joint actions. The term 'foresight' therefore, represents the processes of focusing on the interactions among science, technology and society.*"

In this definition, foresight is seen as a continuous process and not just as a set of future research techniques. There is the assumption of many different futures that should be taken into account and that the actual future we face depends on the choices we make today. Also included in this definition, is the aspect of networking, which is a key characteristic of foresight. Constant consultative procedures and interactions between different actors to ensure feedback. This means that the mobilisation of the different stakeholders within the innovation system and the communication of future options are regarded as important as the actual empirical results. In

foresight, there is no one user and there is not a definite participant in foresight approaches (Cuhls, 1998, 2000). In the figure below, the process of foresight is illustrated:

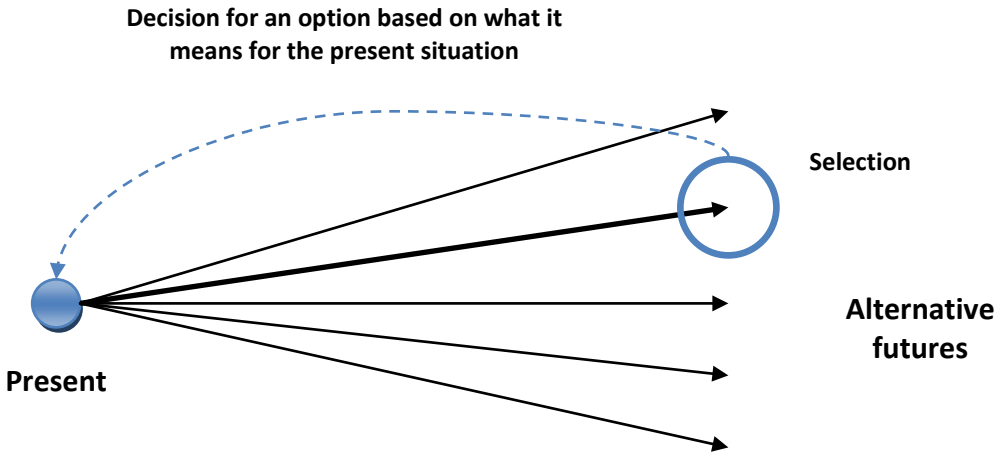
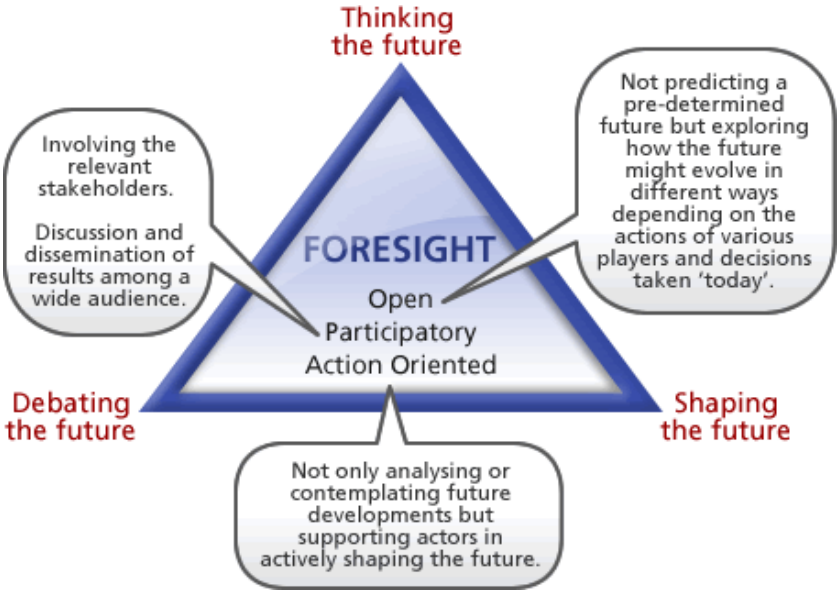


Figure 2.1: Foresight process - adapted from Cuhls (2003)

As the figure shows, foresight starts with the identification of several options, or one option, for the future. However, depending on the criteria, it then goes further to identify the most probable, possible, and/or wishful future. Foresight does not necessarily limit the scope or objects of inquiry, in fact it uses a mix of development drivers and need-orientation. Depending on the particular field of study that is under consideration, in this case security and defence, an environment scanning takes place to see what issues emerge as 'important' in this field. This is followed by a more in-depth approach to look into the future of these issues in relation to the field of study, followed by assessments with regard to certain criteria that are applied (such as the importance of the emerging issue for the field of study). On the basis of the criteria, priorities are set, one option is chosen and an assessment is made what this option means for the present situation, thereby becoming a target. It is well possible that via foresight a selection of relevant areas is made and that a forecasting method examines these areas in more detail, hence an overlap of foresight and forecasting. The foresight part ends then and planning for the future, or 'strategic planning' of the decision begins.

The foresight paradigm reflects a modernisation of strategic planning processes. The innovation of strategic planning processes is necessary to respond to the fact that our world has become more uncertain and complex. The response put forward by the foresight movement is to explore ways of extending existing practices (such as forecasting, futures studies) with a range of innovative approaches and with foresight functioning as an 'umbrella' concept, rather than being one approach in particular. Possible extensions would include approaches that are used in planning, networking of

people, management of group processes and organizational learning. The idea is not to displace existing decision-making and planning processes, but rather, to complement and inform them, so as to increase their effectiveness.



Source: website Foresight for the European Research Area (FORERA), 2008

2.2.1 Origin of foresight

After World War II, there emerged a growing need to find out what the future would look like, so several methods were developed to 'explore' a specific future. However, the processes of these methods were not yet used in a mixed form. The earliest signs of what later be called 'point scenarios', were written with these connotations, in which only one single possibility for each option of the future was described (e.g. Kahn, 1967). This means that not a wide range of options – probably interrelated with each other – were formulated, but rather only one future, just as there is only one present, hence a single linear trend extrapolation (Cuhls, 2003).

However, this line of thought proved not to be very useful. Although we cannot explore *the* future, which remains more or less unknown to us, there are always things that we can anticipate on, while acknowledging a deep uncertainty about some 'unknown unknowns'. As De Jouvenel (1967) describes, from the viewpoint of the present, there is always more than one possible future, as he calls 'Futuribles'. Although this view of *the* future was already taken into account in the most of the future research methods that were developed during the 1960s, most scientists still expected to distil the one most realistic option or prediction that would be possible (Cuhls, 2003). For instance the Delphi method, more explained in section 2.3, also made use of the knowledge of developing single future approaches for selecting the one most promising or probable future option. However, this line

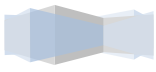
of thought in future research methods suffered a blow when the sudden – unpredicted – oil shock hit most of the Western world in 1973. Interestingly enough, this scenario was foreseen by the prestigious "Global Planning Team" of Shell (Schwartz, 1991; Van der Heijden, 1997). Thanks to the skills of this scenario team, Shell could react adequately, but the warning made earlier that oil cartels could emerge that might decide on restrictions in oil production was largely ignored (Fink et al., 2001; Schwartz, 1991).

The next stage in the evolution of the concept of foresight is commonly captured by the label of technology foresight. This is defined by the OECD (1996) as "*systematic attempts to look into the longer-term future of science, technology, economy and society with a view to identifying emerging generic technologies likely to yield the greatest economic and social benefits*". While the canvas may be broad, including economical and societal dimensions, the focus remained on technology. Within this line of thought, large policy effects could be expected where emerging technologies are likely to have a high impact (EC, 2002).

However, over the past decade the emphasis on technology foresight has shifted to a view in which the economical and societal dimensions are more included (Georghiou, 2002). There has been a significant change in the use of foresight analysis. It has moved away from a pure focus on science and technology that dominated the scene until the mid-1990s. At present, the wide range of tools and methods of foresight are applied in many different fields. The application of foresight not only spread to the business world and government agencies, but also to many different professional fields within these sectors. However, as pointed out by the EC (2002), as the focus of foresight broadened, attention should be paid to the improvement of engaging the interest of those individuals with direct responsibility in the particular research area. Over the last years, there is an increase in the use of participatory networks between key agents to integrate knowledge from a broad range of information sources. Such epistemic foresight communities are rapidly beginning to penetrate the domains of policy makers and their influence is increasing (Voβ et al., 2006). The aim is to achieve transparency and negotiate consensus on risks and opportunities about conflicting viewpoints, so to "*contribute to a normative debate on desirable future developments paths*" (Voβ et al., 2006).

2.2.2 Foresight objectives

Where foresight activities began from rationalist technology-focused approaches, the locus has shifted towards the recognition of broader concerns encompassing the entire innovation system,



including its societal dimensions (Hjelt et al., 2001; Caracostas and Muldur, 1998). The specific objectives of many foresight exercises vary from one another, but nevertheless it is helpful to indicate overarching objectives that are applicable to a broad range of foresight activities. Building on upon the work of Barré (2002) and Van der Meulen et al. (2003), three interdependent objectives of foresight exercises can be detected:

- *Improved systems*: This objective helps the stakeholders share, synthesise and assimilate information about the innovation system at large. This allows the actors to arrive at an improved understanding of the environment and context within which innovations are created and taken into use;
- *Understanding enhanced networking:* This objective is needed to bring in inputs from different professional fields, since much knowledge about the innovative issue is scattered among many stakeholders. This helps to develop a "*systemic vision of the innovation system, to counter the possibility that ensuing activities are fragmented or even counterproductive*" (Tübke et al., 2001). Therefore, foresight activities need to promote enhanced networking among stakeholders, so these efforts can be accomplished;
- *Strengthened innovation activities:* The final objective is comprised of the development, selection and implementation of recommendations that contribute to the innovative performance of the relevant stakeholders and the innovation system at large. Strengthening innovation activities is an important part of foresight exercises, because they seek to promote innovative actions, for instance by outlining policy measures that are expected to improve the innovation environment (Salo et al., 2004).

Salo et al. (2004) explains that a major strength of foresight analysis stems from *"its ability to balance analytic (i.e. production of factual future-orientated statements) and communicative (i.e. catalysis of dialogue processes among the stakeholders) approaches in relation to its stated objectives".* However, there is such a broad range of these approaches (e.g. Delphi-survey, expert panels, critical technologies), each having their specific advantages and disadvantages, that the selection of methods becomes difficult, which will be discussed later on the next section.

According to Havas (2003), foresight teams should anticipate and be prepared for modifications in the actual plan, instead of to pin down the objectives and associated process design at the outset. Still, the tensions arising from attempts to execute large scale foresight exercises according to a rigid blueprint, is also present in the foresight literature (Cuhls, 2003). Therefore, as argued by Salo et al.

(2004), the responsiveness[1] to shifting expectations and objections along the way should be regarded as a major concern and be a key variable of the planning and execution process of every foresight exercise. Depending on the envisaged role that is ascribed to a specific foresight exercise and the changing innovative environment, this need for responsiveness must be met.

2.3 *Distinct from* or *integrated with* other future research methods?

The purpose of this section is to indicate the place of foresight in the wide and complex world of future research methods. Although foresight makes use, and mostly is a blend, of different future research methods, it is important to note that it should not be confused as being the same as, for instance, forecasting or scenario planning. In sub section 2.3.1, one of the first attempts to combine uncertainty, political risk and strategic explorations is discussed: the Political Risk Assessment method. This promising tool was 'hot' late 1970s en begin 1980s, but somehow failed to meet the high expectations and died a quiet death. However, in recent years it regained the interest in both the business- and policy making world. Foresight has its own distinct characteristics as opposed to some of the major future research methods. In the rest of this section attention is paid to these distinct features of foresight and a short review of the future research techniques. It should be noted that it falls beyond the scope of this research to discuss every future research method foresight makes use of, simply because that is already discussed in many other literature and is too much to evaluate here. Instead, the most important methods that had a significant impact on the emergence of 'foresight' will be reviewed here.

2.3.1 The Political Risk Assessment method

Originating from a business perspective, the Political Risk Assessment (PRA) is important for firms that are considering investing in foreign countries. PRA refers to measuring the potential losses to the parent firm resulting from adverse political developments in the host country (Eun and Resnick, 2001). Such risks range from the outright expropriation of foreign assets to unexpected changes in the tax laws that hurt the profitability of foreign assets. Kobrin (1982) describes political risks as contingencies arising from the political environment, not political events and processes per se: "*political events must be regarded as cause, not effect, and hence they are of concern only insofar as they affect managerial strategy*" (Kobrin, 1982). The impact of most political events differ from firm

[1] By "responsiveness" Salo et al. (2004) mean "*purposely designed managerial controls for making warranted mid-course adaptations to foresight objectives and implementation plans*".

to firm and depends more on the firm's structure and strategy than on the environment alone. Roughly, political risks can be classified into two types (Kobrin, 1979; Root, 1972):

- *Macro risk*: adverse political developments in the host country have an impact on all foreign operations. Examples of this are the communist victory in China in 1949 when Mao Tse Tung nationalised foreign assets with little compensation, the Asian currency crisis in 1997, causing chaos on financial markets worldwide, and current political upheaval in the Middle East;
- *Micro risk*: in this case, only particular foreign firms, projects or sectors operated by foreign firms are affected. Examples of this include the predicament of Enron in India in 1995, the kidnapping of oil workers that occasionally take place in the Niger Delta, and piracy attacks on large bulk carriers near the coast of Somalia.

As in the business environment, policy makers operating in highly complex environments, such as defence and security, are coping with flexible, adaptive and strategic responses to changes in these environments. As already argued by Kobrin (1982), Duncan (1973) and Lawrence and Lorsch (1967), uncertainty is probably the crucial variable that links the environment to organisational strategy and structure. Coping with deep uncertainty is also a recurring theme in strategic military planning, as we will discuss in the remainder of this chapter. Root (1972) defines political risk in terms of uncertain future events and Thompson (1967) states that coping with uncertainty is in fact the essence of assessing political risk. Decision makers face uncertainty and ambiguity, which makes it hard for them to specify outcomes of events, assigning probability outcomes for them and to determine preferences (Kobrin, 1982). They are uncertain how the political environment will evolve and what opportunities or threats this will impose. PRA involves ambiguity problems encountered both in current analysis as in future research method and often explains the failure of information flows to converge before decisions need to be made and the lack of communication between managers and assessment specialists, or policy makers and researchers (Kobrin, 1982). The same accounts for defence planning, where deep uncertainty has a profound effect on the structure of defence policy. Instead of focussing on one particular scenario, today's security environment demands a more flexible, adaptive and responsive strategy in order to cope with this uncertainty and ambiguity.

According to Kobrin (1982), the widespread concern about political environments that emerged in the 1970s can be described to the fact that most multinational corporation (MNCs) managers had limited experience in investing in unstable political environments. Therefore, they exhibit uncertainty

about the relationship between the political environment and (foreign) firms as well as about the impacts of future events. Besides, the frequency of expropriations of foreign-owned assets peaked in the 1970s, when as many as 30 countries were involved in expropriations each year, as can be observed in figure 2.2. However, such expropriations have dwindled to practically nothing in the period thereafter, which probably explains the decreasing interest for the PRA tool since then (Eun and Resnick, 2001). Besides, the experience and knowledge about investing in these political sensitive environments also increased, thereby somewhat reducing the need for PRA.

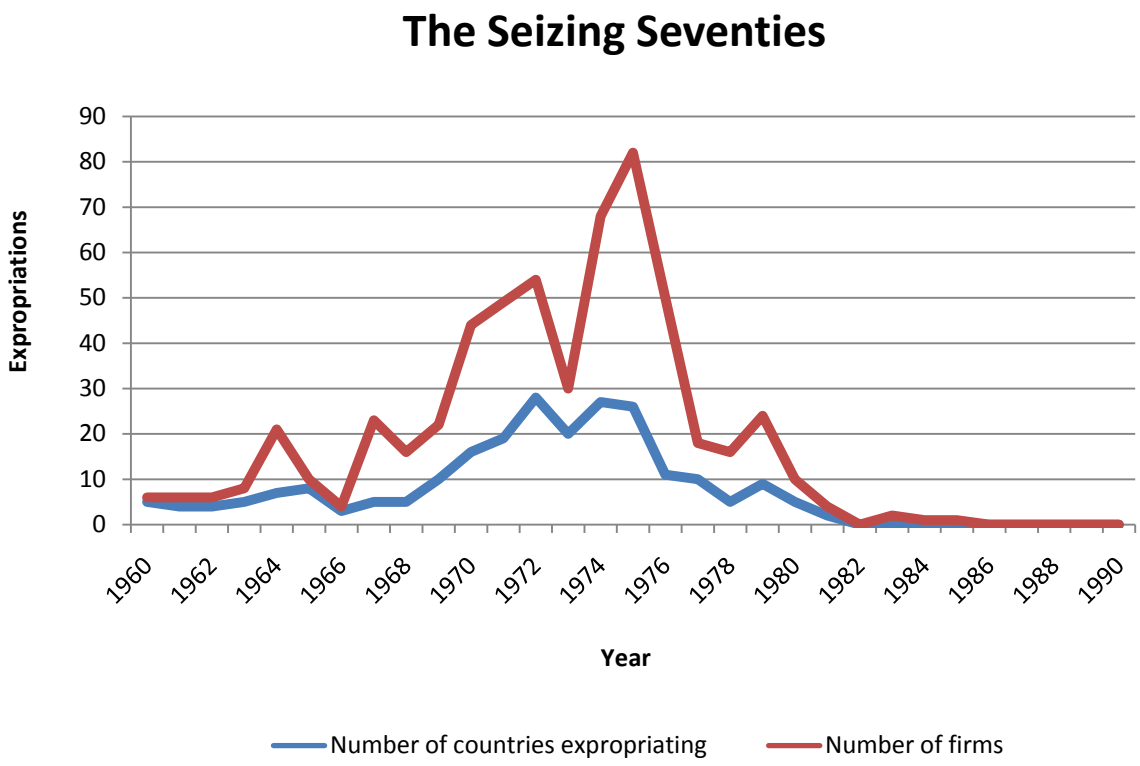


Figure 2.2: Frequency of expropriations of foreign-owned assets.
Source: The Economist, March 27, 1993 in: Eun and Resnick (2001).

This, however, does not mean that political risk is something of the past. In recent years, PRA began its revival, when the increase of FDI into the global emerging markets began to grow and foreign-owned firms were affected by all kinds of geopolitical risk factors (Eun and Resnick, 2001). For example, many business domiciled in Hong Kong are nervous about the intentions of China once it reverts to Chinese jurisdiction, meaning that the rules of the game may change. Also, the increasing tensions between the Arab Islamic world and the West brings the attention back to PRA, as the withdrawal of Shell from Iran due to a changing political environment is the most recent example. Although PRA is useful to measure the potential impact of future political events on firms, uses this for present-day decision making and deals with uncertainty, it must be distinguished from foresight.

Foresight has a much more participatory nature, takes a longer term perspective and incorporates a wide variety of tools to assess emerging issues and upcoming risks beyond that of merely political risks. PRA, on the other hand, is in principle a tool for businesses operating in risky political environments, relies much less on networks, looks at the shorter term and only focuses on the political risk factors for a specific sector or firm.

2.3.1 Future research methods

As discussed in section 2.2, past attempts to develop heuristic models of the future were based on the assumption that there exists a fixed future reflecting a linear continuation of the present (Linstone, 1999; Steinmüller, 1995). Such methods proved not to be very successful since they were oversimplifying reality, thereby neglecting the interrelated complexities of entangled issues. Besides, they were judged on their predictive accuracy at the time the future became the present (Cuhls, 2003). With foresight however, the methodology consisting of a mix of approaches and instruments seems to be more promising. As such, foresight stresses the interactive and participatory nature of dealing with long-term future challenges, thus recognizing the complexity and distributed character of innovation processes. This is one reason why, in the 1990s, when foresight focused attention on a national scale in many countries, there was a growing recognition for this type of research.

Foresight not only looks into the future by using all instruments of futures research, but includes utilising implementations for the present. What does a result of a futures study mean for the present? As Coates (1985) states, foresight is also not the same as planning, because foresight results provide 'information' about the future, thereby acting as a step in the planning and preparation of decisions. Therefore, as there are no fixed targets or activities already thought of, the concept of foresight is more open to the integration of new ideas. This in turn allows for more flexibility and creativity to search for new ways and directions, instead of being necessarily connected to existing ideas. Hence, the ideas are gathered, without caring about their origin. Foresight attempts to explore ways of extending existing practices – future research methods – with a range of innovative approaches and with foresight functioning as an 'umbrella' concept, rather than being one approach in particular.

Methods of foresight vary in terms of type of actors involved, extent of interaction between actors, type of research area and the focus on process or product. Another distinction refers to the exploratory or normative nature of these forward-looking approaches. As explained by Voβ et al. (2006), the former tend to be used "*to identify new emerging developments and resulting risks and*

opportunities that open up new issues and agendas for action", while the latter starts with "*one or several images of the future in order to assess them along different dimensions and to identify the steps and requirements to realise them*". However, in practice, most foresight approaches combine both exploratory and normative elements, using a range of more or less formalised methodologies (Gavigan et al., 2001).

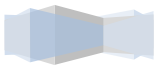
In the *FOREN Practical Guide on Regional Foresight* (European Commission, 2001) it is stated that although the range of different approaches to foresight is very broad, several common features are identifiable: *anticipation*, *participation*, *networking*, *vision* and *action*. This means that these features should be present in different foresight activities for the activity to be reasonably described as 'foresight'. Thus, foresight activities will:

- generally have a long term orientation (focussing on periods over ten years ahead), though the objective is to inform decisions in the present;
- require interdisciplinary approaches to examine a wide (but not diffuse) range of factors, whereby expert knowledge from different kinds of fields is pooled and shared;
- draw on a broad range of visions and knowledge sources distributed across many sectors and many different actors from both the research world and policy makers, so long term views can be integrated with the strategic thinking of decision makers;
- create networks to enhance communication between these different actors. Such networks should preferably be durable, so that it continues to function after an initial foresight activity has been completed;
- employ formal techniques in order to structure and synthesise different views and sources.

It falls beyond the scope of this thesis to discuss every single one of them, so only the approaches contributing most to foresight are discussed below.

Scenarios

Scenarios are used in a wide variety of activities in all kinds of sectors, such as for idea generation in panels, tools for working groups and as a device to communicate foresight results to a wider audience. With respect to foresight, scenarios act merely as an element of the foresight process, with their contributions "*involving the exchange of visions and the deepening of linkages in networks, or as products of the activity that can be circulated to broad audiences. They may be exploratory focusing on what might happen under various circumstances, or aspirational asking how specific*



futures can be achieved (or avoided)" (United Nations Industrial Development Organization, 2003). The way such exercises are produced vary immensely, e.g. simulation models, workshops, specialist expert teams as well as wider samples of expertise. Some methods, such as the scenario workshops, can be highly relevant to the networking aspect inherent to foresight. Participants in such workshops exchange views about strategies, visions and developments, which can yield important insights.

The origin of scenario planning dates back to the period after World War II, when in particular Japanese national programmes focused on the use of this method. In the work of Irvine and Martin (1984), it is discussed that the initial Japanese efforts emphasised on creating a shared vision of the future in the industrial-scientific networks. The authors put much weight on the Japanese experience to describe a wide range of approaches to connect long term views of the future with more evidence based policy making. The use of scenarios has become a 'hot' tool over the years and is widely applied to improving national government decision making, especially in the field of science and technology (UNIDO, 2003).

The most well-known reference in the field of scenario (planning) is the former senior member of Shell's 'Global Planning Team', Peter Schwartz. He founded the so-called Global Business Network (GBN) in 1987. This network has the aim to provide private sector companies the information and scenarios to anticipate their 'possible futures', by allowing them to tap into a range of current trends. Schwartz (1991) stresses the importance of four topics that need attention from the companies: (1) science and new technologies; (2) events that provoke a deep national response and shape public perceptions; (3) attention for remarkable people working in at the intellectual fringes of mainstream society, i.e. former hackers or science 'weirdo's'; and the most controversial (4): music, which he argues is important as an expression of cultural attitudes, such as pop in the 1960s and rap in the 1980s. Schwartz contends that GBN participants should also immerse themselves in challenging environments and alternative communities. Although not all the points mentioned above can be fulfilled by government strategic planning teams, the creation of a broad policy network to share ideas and create cross-disciplinary linkages, the reliance on a wide variety of information sources and the monitoring of emerging issues can be achieved (Leigh, 2003).

Delphi

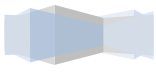
The original development of the Delphi method took place in the U.S., in particular by the RAND Corporation during the 1950s. This method consists of a survey stretching multiple rounds, giving the participants results of the previous round in order to alter, or stick to, the original assessments. Rowe et al. (1991) argue that Delphi makes effective use of group interaction and communication and is

especially useful for long term visions of the future. The Delphi technique facilitates a *"relatively strongly structured group communication process, revealing conflict as well as consensus areas"* (Kuhlmann, 2004). After its application in the civil sector begin 1960s, the method was introduced in Japan, where its use in the science and technology sector proved very successful. Ever since, the Japanese government conducted large scale Delphi studies to assess to impact of upcoming technologies and the changing role of Japan relative to other countries. The further development of this technique in Japan led to the use of it in other countries, even to the point that Delphi – in the context of foresight – has come to mean the Japanese use of that method (Frinking *et al.*, 2005).

Delphi is especially useful for assessing emerging issues and in cases which can be explained very shortly. However, in the case of complex themes, it is better to use scenarios and taking into account what Delphi results can provide as single information pieces (UNIDO, 2003). With the development of foresight analysis in general and the possibilities to filter the different views of different actors in the process, a sole resort to the Delphi method was not considered useful anymore. Consequently, it was somewhat pushed to the background during the last decade by European government agencies and more used in a parallel track with other approaches (Grupp, 1999; UNIDO, 2003). Nonetheless, it is still used as a basic model for foresight analysis. As Könnölä *et al.* (2007) describe, *"the Delphi method gives those in charge of the foresight process rigorous methodological control, thus ensuring that the process does produce a wealth of judgmental statements on the scientific, technological and other relevant developments."* Although government agencies do not totally rely on Delphi as such anymore, as part of foresight exercises the method is still welcomed by many strategists and policy makers. In particular, the semi-quantitative data generated by 'experts', the explorative-predictive and participatory elements of Delphi processes, are regarded as interesting in the context of policy making (Kuhlmann, 2004).

Forecasting

As with foresight, forecasting has many definitions, but for the sake of brevity it suffices to describe it *as "the calculation or estimation of the short-, medium- or long term future or condition in a specific research area based on the results of rational study and analysis of available pertinent data"* (Cuhls, 2003; Webster encyclopaedia, 2007). The research area or research questions need to be known in advance before forecasting takes place. The forecasting research method is often confused with foresight, and although they overlap on some points, there is a real difference between the two. As described by Cuhls (2003), the major differences between foresight and forecasting are that *"in forecasting, (1) the broad area to be forecast has to be known at the start and (2) conclusions for the present, e.g. for specific activities, may be missing."* Foresight goes further than forecasting, including



aspects of networking and the preparation of decisions concerning the future. Foresight not only looks into the future by using all instruments of futures research, but includes utilising implementations for the present. Whereas foresight focuses on the implications of future orientations for today, forecasting sees the future orientations as well as the path into the future as the major points. Another important difference is that foresight is very dependent on opinions of 'experts' and other participants, while forecasting is less dependent on opinions, but relies more on strict methodologies.

Critical lists

Late 1980s, the U.S. government followed the approach of listing so-called critical technologies, beginning with the National Critical Technologies Report of 1991 (Frinking et al., 2005). The Netherlands, France and Germany also made use of such listings of critical technologies. The idea is to apply a set of criteria against which the importance of a particular research direction can be measured with the purpose of identifying national strategic research priorities (UNIDO, 2003). This method is mostly applied in the science and technology field, because technologies are often critical to national interests. National industry and the service sector are typically interested in the identification of the most important technologies, so that they can anticipate to emerging issues and formulate short-, medium- and long term strategic goals. Over the last decade, several countries initiated national foresight exercises to identify national critical technologies, so better insight for R&D spending in priority research areas could be obtained. A possible drawback of this approach is that a relatively small group of experts participate in such exercises. Another danger might be that there is too much focus on technologies, overlooking other issues (e.g. health related or of socio-economic nature). Nonetheless, foresight exercises using critical lists are often designed in such a way that these potential weaknesses are eliminated (UNIDO, 2003).

Expert panels and networks

The method of expert panels typically consist of collections of 10-20 individuals – the experts – that deliberate upon the future of a particular issue during several months. A well-known example is that of the U.K. Foresight programme during the 1990s, which made use of such panels that each independently dealt with a specified area they thoroughly examined. The effectiveness of each panel was largely dependent on the networks of its members (Schultz, 2007; UNIDO, 2003). Havas (2003) argues that loosely controlled expert panels allow its members to engage in intensive deliberative processes. Despite characteristics similar to that of foresight, the method of expert panels is not very prominent in the foresight literature compared to for instance Delphi and scenarios. However, foresight as a participatory, discursive process should also be based on methods such as expert

panels, because they not only open up the foresight process to many participants but also form a platform for in-depth discussions and debate (Könnölä et al., 2007).

2.3.3 Conclusion

The foresight method aims to create venues where leaders from government, business, science, technology, and various other groups can come together to discuss and share both normative and positive views on future technology developments and their effects on important economic sectors and social structures. These deliberations are intended to create channels for communication as well as a better vision of what might lie over the horizon. Details of the method may vary, but all foresight processes are characterized by disciplined group inquiries into the trends affecting future outcomes as well as the actions by which these trends and outcomes may be adjusted. As Salo et al. (2004) put it, the defining feature of foresight is "*the creative generation of synthetic knowledge, whereby future-orientated expectations are jointly produced, combined and assimilated by soliciting inputs from participants for critical reflection*" (Salo et al., 2004). The major benefit of doing foresight analysis is this triangulation of data sources and mutual learning, to provoke discussion about the way participants view the future. It is the strength of foresight that these changes are gradually produced during the process and that the objectives and associated processes can be adjusted, hence are not produced as formal output at the end of the exercise (Havas, 2003).

As mentioned, foresight has similar characteristics as many other future research methods and mostly acts as an 'umbrella' concept rather than a totally separate research approach. However, it differs on two important accounts as opposed the majority of future research methods (UNIDO, 2003; EC, 2001):

- More than with other approaches, foresight is highly related to *present-day* decision making. To develop anticipatory strategic knowledge, key agents of change and sources of knowledge are brought together. Via networking processes a shared sense of commitment can be created in order to guide strategic visions and plans, in particular to make them more flexible and robust to changing circumstances. Such plans and visions must then be explicitly related to present-day decision making;
- *Wide participati*on plays a more significant part in foresight than traditional future research methods. Expert panels or Delphi are the most well-known examples where knowledge is integrated from a variety of professional fields in order to involve a wider spectrum of the

'knowledge society' in decision making. This element is key to the so-called 'foresight culture', which is often explicitly intended to establish networks of such epistemic communities. The application of interactive approaches should be able to respond better to emerging issues and the involvement of a wide variety of key agents often goes well beyond the narrow sets of experts employed in the Delphi or expert panel approach. Lempert, Popper, and Bankes (2003) argue that contrary to the Delphi method, which emphasizes the product of its deliberations as a principal goal, foresight exercises focus on the deliberations themselves.

2.4 Critique on foresight

In practice, also foresight analysis struggles with the multiplicity of plausible futures. In the context of foresight, there is still a deep uncertainty surrounding the exploration of future possibilities and represents no panacea to cope with that. Nonetheless, the general tendency amongst foresight participants is that they often share an unspoken assumption that the goal of the process is to minimize the irreducible uncertainties inherent in the forces driving toward an unknown future. This perception may flow from the conviction that predictions are necessary precursors to effective action. Foresight as currently practiced certainly lacks several mechanisms that can make effective use of multiple futures. The process cannot just acknowledge deep uncertainty and simultaneously provide operational policy recommendations, or as Popper (2002) puts it *"when it achieves the one, it invariably sacrifices the other"*.

The traceable influence of foresight exercises in the actual decision making is hard to assess, because it is hard to observe how the participants' mindsets and decisions are influenced, as well as the impact on the wider public debates. Voβ et al. (2006) address a number of shortcomings in the practising of foresight:

- There are some critical notions about the biases brought in by the foresight process itself. Can the expectations raised in a foresight exercise really be trusted? How can participants protect themselves against the fallacies of over-optimistic expectations and false promises they raise in a foresight exercise? As briefly discussed above, there are many uncertainties and ambiguities that cannot be anticipated on and a naïve belief in some expectations may lead to a misallocation of resources and disappointment at a later stage;
- The findings of so-called 'impressionistic' foresight exercises - where workshops and expert panels are the main sources of knowledge - carry the risk of being insufficiently rooted in a

scientific base. To cope with this shortcoming, a consolidated integration of retrospective and prospective scientific methods and participatory processes should help enhance the scientific credibility of foresight results;

- Although sophisticated and well thought-through foresight exercises are increasingly used in policy making and coordinating strategic agendas, the subsequent strategy processes often lack the same degree of sophistication.

To conclude, there is a dilemma between on the one hand the need to keep future options open in order to be adaptive and reflexive to changing circumstances and on the other hand the willingness to actively shape the future. Although foresight can support the discussion of uncertainty by creating alternative views of the future, it has no means of recommending practical strategies to address that uncertainty. Foresight must downplay the multiplicity of plausible futures and settle on one or a very small number of forecasts in order to provide policy conclusions (Lempert, Bankes, Popper, 2003).

2.5 Foresight analysis in policy making

From a historical point of view, the 'future' and the imagination of things to come was only seen in a one-dimensional way. Put differently, the present and events that are coming, which is *the* future and only *one* future seemed to be possible. In the past, the only criterion for forecasting and futures research in general was a 'correct' prediction of a certain occurrence; with the consequence that longer-term forecasting was regarded with suspicion and was neglected by many planners and politicians (Coates *et al.*, 1994; Gillwald, 1990). At least in Europe, it took another 20 years to regain the reputation of decision makers in the governmental and public administration sector. However, this revival did also caused a changed label of 'foresight': "*originally, foresight and forecasting were used equivalently, but meanwhile, there is a real difference in the understanding of forecasting compared to foresight"* (Cuhls, 2003), as described earlier.

Over the years, foresight activities have become a familiarised method in the tool box of government policy makers and other public bodies. Cuhls (1998) states that in the context of policy making, the most important objectives are:

- To enlarge the choice of opportunities, to set priorities and to assess impacts and chances;
- To prospect for the impacts of current research and technology policy;
- To ascertain new needs, demands and possibilities as well as new ideas;

- To focus selectively on economic, technological, social and ecological areas as well as to start monitoring and detailed research in these fields;
- To define desirable and undesirable futures;
- To start and stimulate continuous discussion processes.

With regard to the use of foresight in policy making, an important point is made by Eriksson (2003), who argued that there should be a balance between adaptive and pro-active elements of policy strategies. He calls these opposing strategies 'strategic opportunism' and 'strategic commitment', where the former emphasises adaptation and flexibility and the latter on goal-oriented steering of the future. Eriksson (2003) mentions four reasons why there is a need for a more adaptive approach to policy making:

- *Adaptation to external developments and unexpected events*: aimed to take precautions against major external events;
- *Adaptation to other actors*: key decisions are increasingly taken by several actors collectively instead of centrally by a single actor, thereby making the adaptation of a strategy to those of other actors imperative;
- *Adaptation to a multi-level policy context*: adaptation to other levels of policy making needs to take place, where international and European structures frame regional and national processes;
- *Adaptation over time*: policy roles change in the course of particular processes and key policy functions may move down to lower policy levels.

By translating findings of foresight exercises into inputs for policy making strategies, foresight can be a valuable instrument to help make policy making more reflexive (Eriksson, 2003).

2.5.1 "Strategic foresight"

Leigh (2003) argues that the technique of 'strategic foresight' has much to offer for governments. Identifying emerging issues, drawing on a wide variety of information sources and long-term scenario planning, can lead to more durable and effective policy. In what Peter Schwartz calls 'the art of the long view', governments should both anticipate future challenges (both problems and opportunities) and identify possible strategies to improve the effectiveness of policy (Schwartz, 1991). In developing such a 'strategic foresight' model, policy makers should look to the lessons from other governments as well as from scenario planning done in the private sector. As Leigh (2003) describes: *"strategic*

foresight involves broadening the menu of policy options, and taking into account future scenarios that might affect today's decisions". Drawing on Grant (1988) and Schwartz (1991), Leigh (2003) mentions that there are five ways in which strategic foresight can lead to a more innovative government:

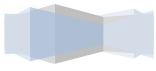
(1) *Anticipating emerging issues*: a wide variety of potential problems should be tackled, from the risk of a pandemic to economic slowdown to energy security issues. Policy makers should aim to spot opportunities for policy development, thereby accounting for the scenario horizon each 'threat issue' has. For example, environmental dangers several decades may be an appropriate horizon to anticipate with a considerable degree of certainty. This means that, depending on the issue, foresight teams should not be afraid to design policy over time horizons that far exceed that of the present government;

(2) *Identifying unanticipated consequences*: As the risks to the society become increasingly complex, global and invisible, foresight can help shift the focus of politicians and bureaucrats onto emerging challenges and focus on the unintended consequences of their proposals (Beck, 1992). As Giddens (1998) states, our current structures to deal with these new hazards must be improved by engaging in the "*active exploration of risk environments*";

(3) *Getting a sense of the bigger picture*: The overcoming of stovepipes between government departments and agencies, but also between emerging issues, is an important feature of foresight. This means that foresight teams should look at issues that crosscut these traditional demarcations. As Leigh (2003) notes, "*strategic advice should be broadly based, and wherever possible be backed up by empirical evidence, so that it can contested and debated by others in the policy domain*";

(4) *Drawing on a wide range of information sources*: In order to identify weak signals[2] and new trends effectively, foresight analysts should constantly cast a wide net of sources when trawling for information, such as think-tanks, academics, other governments. Unconventional methods such as searching the internet as a vacuum cleaner to spot new

[2] Ansoff (1975) defined weak signals as "*imprecise early indications about impending significant events*". Later on, this definition has been expanded to accommodate additional characteristics, such as "*new, surprising, uncertain, irrational, not credible, difficult to track down, related to a substantial time lag before maturing and becoming mainstream*" (Coffman, 1997; Harris and Zeisler, 2002).



scientific breakthroughs, popular perceptions and fringe conventions in blogs and news alerts are also part of this;

(5) *Involvement of the public*: Not only the views of senior policy makers must be affected, but by producing public reports a wider, more public, audience can be involved. With the U.K. government *Foresight Competency* for example, the aim is to consult widely before producing a report so to advance public debate on the long term priorities of the government.

The point of the scanning process is to learn to identify potentially significant changes in time to monitor the emergence of an issue while creating contingency plans to manage it (Schultz, 2006). Already in the 1970s Graham Molitor created a model in which he showed key factors in tracking and measuring the evolution of public policy changes. These factors illustrate that the process of change invariably starts with aberrant and unique events, when aggregated, reveal meaningful patterns. These are then picked up by authorities in the scientific, technical and professional communities to analyse such phenomena (Molitor, 1977). The writings of these authorities lead to widespread dissemination of their ideas and are of increasing interest to politicians that will pick up on such trends. In an adapted version of Molitors model below, the life cycle of emerging change is shown in Figure 2.3. It depicts the trend's diffusion from an emerging issue into a full-blown trend, both in terms of observable number of cases and in a gradually increasing public awareness.

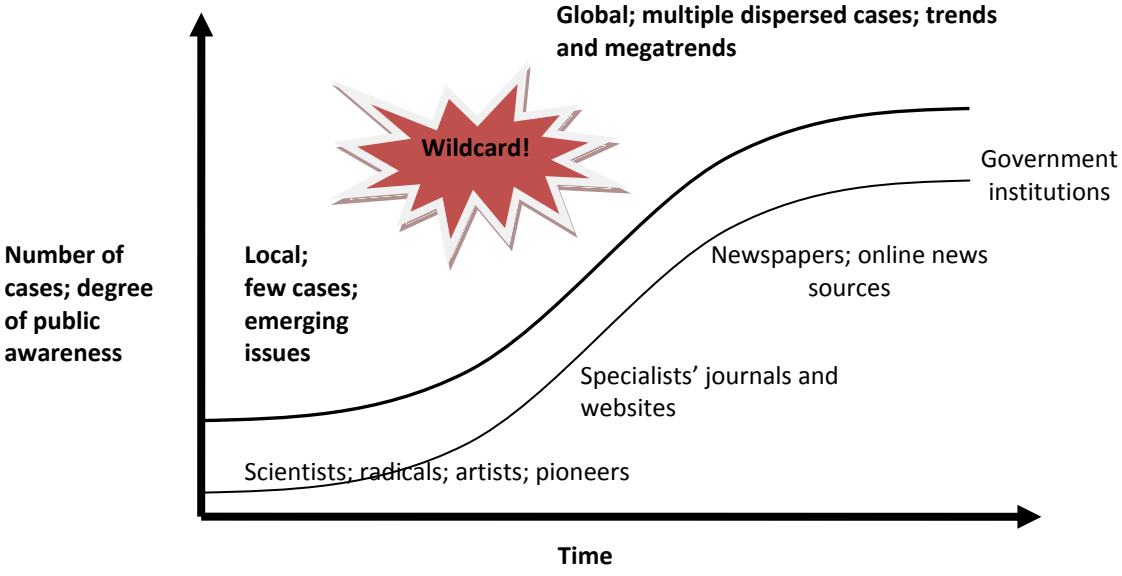


Figure 2.3: Life cycle of an emerging change

Provided that an emerging issue evolves into a full-blown trend, instead of disappearing, the growth line follows a typical life cycle S-curve. Policy makers or strategic planners should identify emerging issues near the origin point of the curve, so there is sufficient time for policy response. Following the five ways of strategic foresight, as mentioned earlier, the search for 'patient zero' has a greater chance for success, even if there exists little documentation on the emerging issue. As indicated by Schultz (2006), perceiving weak signals of change requires extensive monitoring of publications and activities on the far left of the curve, such as specialist and fringe publications, blogs, conferences and media output. For the sake of this research, it is important that a robust scanning strategy will be used so that the usefulness of data emerging from different points of the curve can be discriminated. As will be explained later on in chapter four, the use of text mining can be of great help in this endeavour.

2.5.2 Emergence of foresight in U.K. government

Before continuing this section, it should be noted that the use of foresight in U.K. and U.S. defence policy is more extensively described in chapter 3, where the structure of the defence policies and the role of foresight in it will be discussed more thoroughly. For now, the purpose is only to show how the concept of foresight has made its intrusion into the U.K. and U.S. policy making world.

The idea of foresight in policy making is progressing in many countries. As mentioned in the introduction chapter, the U.K. government set up a major Foresight program in 1994. Operating within the Department of Trade and Industry, it aims to present a view of what the world will look like in the coming decades. Over the years it has broadened its original focus on technology and innovation to many other foresight panels reporting on various themes (e.g. crime, climate, information systems) and sectors (e.g. chemicals, healthcare, utilities)[3]. Each panel consults with a wide range of actors, such as business, academics and the public. The program not only identifies potential threats, but also opportunities that can arise from new science and technologies, or considers how future science and technologies could address key future challenges for society. In sum, "*the Foresight program, together with the Horizon Scanning Centre, produce challenging visions of the future to ensure effective strategies now, by providing a core of excellence in science based futures expertise and access to leaders in government, science and business*"[4]. The interest in the projects of the Horizon Scanning Centre is widespread in the U.K. government. In 2004, it began to

[3] http://www.foresight.gov.uk/index.html
[4] http://www.foresight.gov.uk/About_Foresight/The_Programme_2005/Index.html

work with two pilot scanning projects with the 'client' Departments of the Home Office, Trade and Industry, and of Constitutional Affairs. In addition to these centralised scanning projects, several other U.K. government Departments conduct their own foresight activities of horizon scans, including the Department of Defence.

According to Schultz (2006), the context in which the U.K. government implements foresight includes several intersecting challenges:

- *Specific agencies are under-funded and under-resourced for the complexities challenging them as well as for emerging turbulence and the surprises it will generate*;
- *Both politicians and civil servants are media-traumatized and media-wary in the wake of ''mad cow'' disease; genetically modified food protests; Iraq intelligence issues; and other political crises serving as fodder for tabloid tempests*.

With regard to the latter, Schultz (2006) argues that in responding to a 'hot' media item, politicians need to inform the public with unimpeachable information. Such strategies lead to in-depth expert analysis of past data and currently verifiable trends. In itself this is not a problem, but the solidly researched policy papers on relevant issues rarely address in what way the issues itself will change over time. The evidence describing the issue is how it is at the moment, as if frozen in time, hence not leaving much space for future development of the issue.

Within the program, the most emphasis has been placed on science and technology. In other European countries, but also in Asia and the U.S., this approach has found its way as well. It helps policy makers focusing on long range challenges, instead of on the shorter term disaster management. In addition to science and technology, foresight analysis has became more politicised and also touches on social and economic issues in order to gain insight into trends across a broad range of the public sphere (Lempert, Popper, and Bankes, 2003).

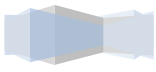
2.5.3 Emergence of foresight in U.S. government

Under President Nixon in the late 1960s, the U.S. government decided to include strategic planning as an important part of policy making. This eventually resulted in the short-lived National Goals Research Staff, but was disbanded in 1970 (Leigh, 2003). Its goal was to carry out effective scenario planning by:

> "*forecasting future developments, and assessing the longer range consequences of present social trends; measuring the probable future impact of alternative courses of action, including measuring the degree to which change in one area would be likely to affect another; estimating the actual range of social choice ... in light of the availability of resources and possible rates of progress; developing and monitoring social indicators that can reflect the present and future quality of American life ... summarizing, integrating and correlating the results of related research activities being carried on within the various Federal agencies, and by State and local governments and private organizations*" (National Goals Research Staff, 1970).

According to Grant (1988), the reason of the collapse was political infighting. Long range planning became fraught with difficulty due to the highly politicised environment in which the government had to operate, in which long term strategic planning (beyond the next elections) found no response. In their much discussed "*Reinventing Government*", Osborne and Gaebler (1992) note that an important form of innovation is an 'anticipatory government that prevents rather than cures'. Such an anticipatory government has a strong history in certain areas, including defence policy. With regard to the U.S., the defence policy think-tank RAND pioneered in the use of alternative futures, or 'scenarios' (Davis, 1996), that allowed policy makers to develop an extensive view of uncertainties in a particular area and to use strategies to shape defence policy against a broad range of the scenario space.

At present, an important institution using foresight to assist government policy making is the United States Government Accountability Office. The GAO assists Congress to improve efficiency, effectiveness and strategic management within the federal government by providing foresight analysis on various issues. In a testimony of the GAO from 2007, it is stated that "*GAO's work can provide the Congress with foresight by highlighting the long-term implications of today's decisions and identifying key trends and emerging challenges facing our nation before they reach crisis proportions*" (GAO, 2007). The GAO's efforts in using foresight focus on a wide range of emerging needs and identify governance issues that must be addressed by policy makers. This way it supports Congress to develop flexible, adaptive and robust strategies to respond effectively to all kinds of challenges and risks to the future of the U.S.



2.6 Foresight analysis in defence planning

Although foresight and strategic planning started out in non-military applications, its central ideas are now also widely used in the military domain. In today's defence planning, *uncertainty* is said to be the biggest enemy and strategic planners are often faced with it on a massive and ubiquitous scale (Davis, 1996). Planners and high level decision makers argue about whether coalition forces will continue to be engaged in numerous smaller-scale contingencies across the world, thereby affecting personnel readiness and morale. Others wonder what the future will bring with regard to Weapons of Mass Destruction (WMD), fragile states that may pose a danger to the West, the increasing nationalist course of Russia, or 'wars' on terrorism and drugs. In the past, such predictions were often abominable. For example, a large historical turning point as the fall of the Iron Curtain was not foreseen by many and neither were the U.S. involvement in the Balkan in the 1990s and Saddam's invasion of Kuwait in 1990 (Davis, 1996). At a deeper level, there exist more technical uncertainties that are also troublesome. If more battles are fought on the ground, how does this affect the development of expensive fighter aircrafts? Do we need to make large investments in stealth fighter wings or Intercontinental Ballistic Missiles, or can future conflicts provides us with such significant strategic and tactical warning that we can depend on that? What if large aircraft carriers become vulnerable to long-range missiles, does the DoD need to invest in a new generation of submerged platforms (Davis, 1998)? To conclude on this point, high-level defence planning is beset with problems of (deep) uncertainty. These uncertainties profoundly affects the choice of a course of action, but cannot be substantially resolved by merely working harder (Davis, 2007). They are matters of the highest significance and must not be regarded as minor annoyances.

2.6.1 "Point scenarios"

In the period from the 1960s to the 1990s the defence programmes of the U.S. and U.K. worked with so-called 'point scenarios'. This paradigm geared the force structure towards specific bounding threats, most notably the Soviet Union during the Cold War, where capacities and strategies were developed on the basis of one such threat or 'point scenario'. According to Davis (2002), point scenario planning fixates on *"particular enemies, particular wars, and particular assumptions about those wars – a fixation that comes at the expense of more flexible and adaptive planning."* A symptom of the problem can be seen in the enormous attention paid to the notorious two *Major Theatre War* scenarios involving Iraq and North Korea a few years ago, while the Iranian nuclear threat pose one at present. Davis (2002) explains that solid capabilities– and operations planning require concrete, specific scenarios (either real or credibly constructed), that becomes more difficult when one moves away from such fixations. When dealing with a relatively smaller 'scenario space' of

possible threats 'point scenarios' was often convenient, but when dealing in a security environment surrounded by deep uncertainty, it becomes troublesome. The defence planning system was often structuring its programmes as though the illustrative scenarios were "the" actual scenarios, resulting in *"organizational inertia, 'stove-piped' management, service oriented processes, and the presence of a decentralised power structure"* (Davis, 2002).

2.6.2 FARness

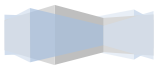
To provide for a long term context for strategic planning, Davis et al. (2002) propose for strategic plans that are robust against a much wider range of the scenario space, something they call "*the degree of FARness"* (**F**lexible, **A**daptive and **R**obust strategies). Davis et al. (2002) describe these terms as follows:

- **F**lexibility: "*the ability to perform different missions (e.g., in one region or another, or to go from war fighting into a security and stabilization activity) or different tasks.*"
- **A**daptiveness: "*the ability to adjust readily to diverse circumstances (e.g., political-military context, enemy strategies, warning time).*"
- **R**obustness: "*the ability to withstand both foreseen and unforeseen shocks, such as surprise attacks or the loss of an important battle.*"

This does not mean that the most "optimal" solution must be found, e.g. making a best estimate of the future and preparing only for that. Rather, FARness stresses the need to develop strategies that are robust against a wide set of "scenario spaces" (Davis et al., 1996; Davis, 2002). The method of foresight is interesting because it addresses the need to include humans effectively in dealing with uncertainty. Foresight has the purpose not to 'predict' how developments will unfold, but it rather recognises enough of the possibilities to materially and mentally prepare to adapt when surprising developments occur.

2.6.3 Adaptiveness

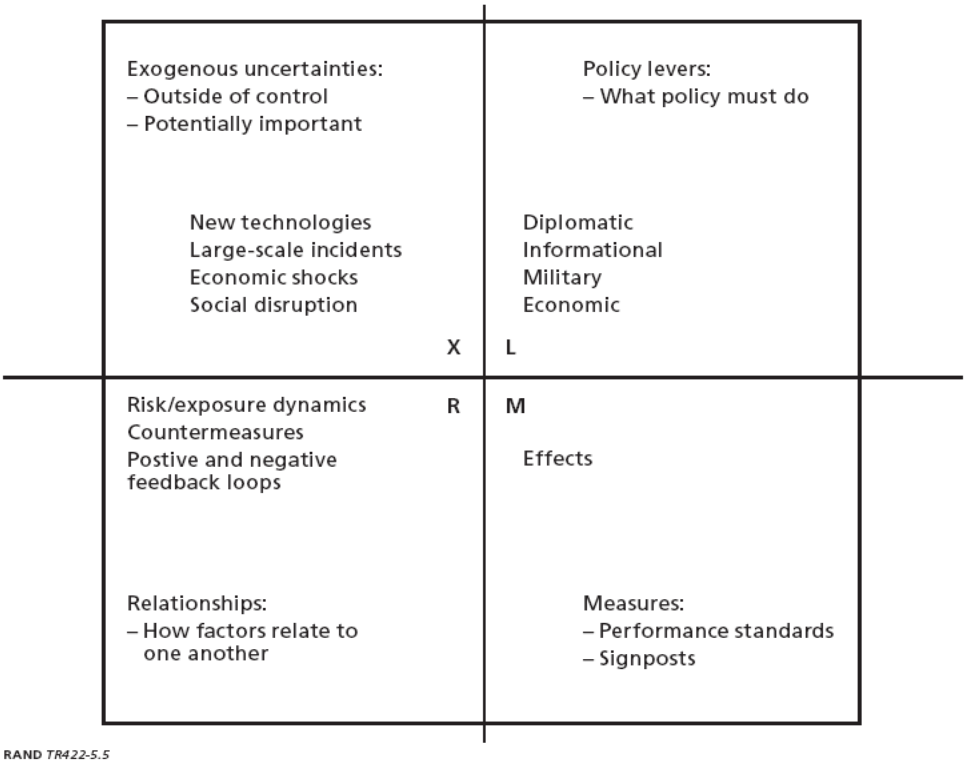
In this modern era of war fighting, defence planners need to deal with uncertainty by embracing adaptiveness. As Voβ et al. (2006) argue, the basic philosophy behind the notion of adaptivity or 'adaptive planning' consist of "*deferring actions and choices as long as possible, that is, until more knowledge is available, in order to cope with uncertainty.*" Collingridge (1980) developed the so-called 'Collingridge dilemma', where he explained that the (dis)advantages, opportunities, risks and



costs associated with new upcoming technologies in the early stages of development is difficult to determine, thereby making decisions about the direction of emerging technologies very hard. However, the longer one needs to wait to make informed choices, the technological options have become so entrenched that effective decision making are no longer possible. Adaptive planning aims to keep options open – by having parallel tracks of alternative options – following a staged development process without making definitive choices until more is known about the technology or context in which it is ought to be used (Voβ et al., 2006). More recently, adaptive planning approaches are also concerned with the notion of the 'real options portfolio', originating from the world of finance to offer investors a portfolio of options to hedge against financial risks. The 'real options' model stresses the uncertainty inherent to the future, how this constrains our possibilities to shape it and that we must adapt to this. Voβ et al. (2006) argue that such a portfolio of real options needs to be 'robust', implying that they are useful and do well under a wide scenario space. Also, policy options need to enable adaptivity, meaning that they need to maintain the ability to exploit emerging opportunities or respond swiftly to unexpected events.

2.6.4 XLRM framework for foresight

With the foresight approach used for military applications, potential courses of action are constructed in order to achieve desirable futures, i.e. futures that have potential good features and are without the undesirable features that we fear (Davis et al., 2007). Traditional scenario-based defence planning has some major weaknesses for robust long term policy analysis. Such planning always struggles with the multiplicity of plausible futures. As we already observed with the use of 'point scenarios' in the past, the choice for only a small number of scenarios to predict a highly complex future is arbitrary. As Lempert, Popper, and Bankes (2003) argue "*scenario techniques are tremendous boons to forward-looking strategic thinking but are not formally linked to the operations of decision making.*" Therefore, these researchers of RAND proposed a conceptual framework called "XLRM" to address these weaknesses. XLRM is a framework that uses e**X**ogenous uncertainties, policy **L**evers, **R**elationships and **M**easures with the original purpose to illustrate a method for understanding possible futures on the very long term (> 100 years) and thereby generating many scenarios.



Source: Davis et al. (2007)

Lempert, Popper, and Bankes (2003) define these four key terms as:

(1) Exogenous uncertainties (**X**) are *"factors, outside the control of the decision makers, which may nonetheless prove important in determining the success of their strategies. In the language of scenario planning the Xs help determine the key driving forces that confront decision makers."*

(2) Policy levers (**L**) are *"near-term actions that, in various combinations, comprise the strategies decision makers want to explore."*

(3) Relationships (**R**) *"describe the ways in which the factors relate to one another and so govern how the future may evolve over time based on the decision makers' choices of levers and the manifestation of the uncertainties, particularly for those attributes addressed by the measures."*

(4) Measures (**M**) are *"the performance standards that decision makers and other interested communities would use to rank the desirability of various scenarios."*

The objective of this framework is to distinguish between policy actions taken in the present and those which may be available in the future. In each section of the framework, key parameters are

used to construct a broad range of scenarios. These parameter values are then constrained to reproduce past trends as well as future explorations of changes in demographics, economic growth, technological developments, large scale disasters, etc. In each step of the analysis of these parameters and plausible scenarios, potential courses of action and 'best' strategies are constructed in order to achieve desirable futures. The measurements (box at the bottom right) then assess how (un)desirable an outcome is for any of the actors. This attempts to answer whether the intended effects have been achieved or if we are on the 'right track' to achieve the intentions. The relation of XLRM with foresight lies in the fact that they both rely on a multitude of scenario exercises, and the former can be seen as an approach for the latter (Davis et al., 2007). Although XLRM was originally developed to assess scenarios on the very long term, it is also useful for shorter term futures and/or small numbers of scenarios to support decision making in complex, high-dimensional decision spaces inherent to long term defence planning problems (Davis et al., 2007).

2.7 Foresight analysis in the business environment

The importance of foresight has also increasingly penetrated the domain of strategic planning within the business environment. Already in the late 1970s, Henry Mintzberg discussed particular structural configurations that enabled organisations to deal with particular contingency factors. He argued that the uncertainty of the environment and the complexity of basic tasks formed the key dimensions in explaining different organisational structures. This contingency approach assumes that an organisational structure depends on several internal and external factors, indicating that there exists no 'one best way' to organise a corporation (Mintzberg, 1979). He stresses that managers do not always need to design their strategies formally, instead, they must leave them more flexible to be able to adapt to a rapidly changing environment. Formal strategic planning only makes sense when an organisation is sure of its environment and has a need for a tight coordination of complex intricate operations (Mintzberg, 1994). As described by Irvine and Martin (1984; 1989), the process benefits of foresight within businesses can change mindsets and help strategists create new views on research activities and user needs: "*the use of foresights methods will often persuade participants to buy into, or even develop, an organisation's strategic vision*". They summarise these aspects of the foresight process in terms of the "*five C's*" (Irvine and Martin, 1984):

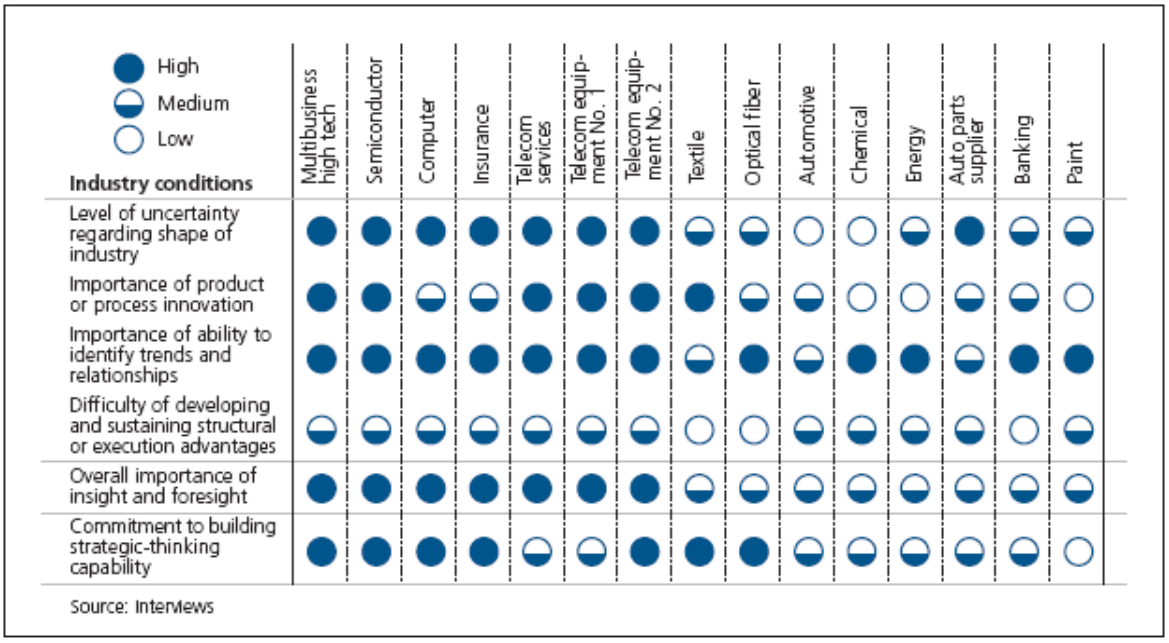
- *Communication*: bringing together various groups of people and facilitate a structure in which they can communicate;
- *Concentration* on the longer term: forcing individuals to focus seriously and systemically on the longer term;

- *Coordination*: enabling different groups to coordinate their future R&D activities;
- *Consensus*: creating a measure of agreement on research priorities and the future strategic directions;
- *Commitment*: generating a sense of co-ownership to the results among those who will be responsible for translating them into concrete technological developments, innovative products and research advances.

This line of thinking of adapting the firm to complex environmental and organisational constraints still prevails in modern-day business thinking. In this increasingly globalising world, the support for a broad-based strategic thinking capability to help firms make dynamic decisions about their strategy in a fast changing environment and marketplace is still strong. Factors like regulatory upheavals, globalisation, political shocks, shifts in consumer tastes, the rise of non-traditional competitors, cyclical economical changes and other environmental forces are also transforming companies into using the principles of FARness. Becker (2002) states that it is useful to categorise foresight in terms of its "*more intermediate functions and impacts for the company, which are: anticipatory intelligence, direction-setting, determining priorities for funding decisions, strategy formulation and innovation catalysing"*. Companies need to identify upcoming opportunities and threats so they can be accounted for in their strategic planning. Fink *et al.* (2005) argue that with the emergence of resource-based planning, firms emphasised more on organisational resources and more internally focused models of strategy. This means that such scenario models were developed to complement external scenarios in order to better address complex external challenges, hence provide strategic foresight. By combining both external and internal strategy scenarios, firms can create a so-called 'future scorecard', which is "*a continuous measurement tool to complement other performance measurement approaches in order to deliver the openness and flexibility needed for sustainable performance in today's increasingly turbulent business climate*" (Fink *et al.*, 2005).

In a study of Barnett and Berland (1999), where they examined large companies in 12 industries, it was found that all of these companies explicitly made a commitment to the development of broad-based strategic thinking capabilities. The use of insight and foresight was considered as most valuable in specific kinds of industries as well as the level of diversification and decentralisation (see table below).

The importance of insight and foresight



Source: Barnett and Berland (1999), in: *The McKinsey Quarterly* (1999), number 2

This table shows that strategic planning can help identify emerging issues and trends, understanding key implications of complex relationships between them and reduce the uncertainty surrounding decision making processes. It can be observed that the overall importance of insight and foresight as well as the commitment in building strategic planning skills, is seen as very relevant (Barnett and Berland, 1999). In another study that sheds light on the current practices and use of foresight in the private sector, done by Becker (2002), representatives of 18 companies in Europe using foresight activities for strategic planning purposes were interviewed. It followed that very few companies used foresight for many different purposes demanding a combination of individual functions, but mainly to use it in an advisory role and deliver future-oriented information support strategic decision making processes. Instead of formulating strategies, foresight is more used to identify critical future events or spot possible external 'shocks' for their businesses. For some companies, however, foresight goes beyond this and contributes directly in the strategy formulation process by encouraging better communication, forging stronger links between the 'innovators' and making 'foresighters' responsible for strategic decision making (Becker, 2002).

In dealing with uncertainty, Courtney (2001) argues that companies basically have two options to make the right strategic choices: *shaping* and *adapting*. The former generally attempts "*to get ahead of uncertainty by driving industry change their way*", while the latter "*takes the existing and future industry structure and conduct as given*" (Courtney, 2001). Adapting strategies in the business environment try to find defensible positions in the current industry structure. As Courtney (2001) describes: "*when high uncertainty prevails, they attempt to win through speed and agility in*

recognising and capturing new opportunities as the market changes". This of course has commonalities with modern-day defence planning, where strategies need to be 'FAR' to deal with an uncertain, rapidly changing security environment. Firms try to manage uncertainty as well by building flexible structures in order to respond to a changing environment and market needs. Courtney (2001) observed that executives facing higher uncertainty are more in favour of an adaptive strategy, because most strategic planning methods are often not suitable to generate deep foresight into opportunities arising in fast changing environments. If firms do not have such foresight, it makes it very hard to implement successful shaping strategies. Firms that do generate good foresight and become good *shapers* mostly rely on improved strategic planning processes including scenario planning, Delphi and critical lists, so they can consider "*the full range of strategic shaping and adapting options*" (Courtney, 2001).

2.8 Conclusion

It is clear that the use of foresight analysis has gained importance over the years. The basis of foresight began after WO II, when there was a growing need to find out what the future would look like, so several methods were developed to get a better insight on 'the' future. Out of the myriad of future oriented research methods, the concept of foresight began to emerge in the domain of science and technology. While the focus remained on this domain, economical and societal dimensions also started to be included in exploring a specific future, but also the possibility of *multiple futures*. Foresight is mostly seen as an 'umbrella' concept, where a wide range of tools and methods are applied in many different fields. However, foresight entails more than just that: foresight is highly related to *present-day* decision making and wide participation and networking plays a much more important role in foresight than in traditional future research methods. There is an increasing use of participatory networks between key actors to integrate knowledge from a broad range of data sources. Although foresight exercises vary in methods used, all are characterized by disciplined group inquiries into the trends affecting future outcomes as well as the actions by which these trends and outcomes may be adjusted. The application of foresight analysis is of great importance in the military domain, where the move away from 'point scenarios' to strategies that are more flexible, adaptive and robust against a wider scenario space have become more dominant in present-day defence planning. Foresight has also increasingly penetrated into the strategic realm of the policy- and business world and many different professional fields within these sectors.

From the literature as described in this chapter, it follows that foresight is regarded as a useful method in dealing with deep uncertainty in fast changing internal and external environments. Therefore, for the purposes of this thesis, the normative assumption is made that the use of foresight analysis should be reflected in the formulation of the defence policy of the U.S. and the U.K. In the following chapters more insight will be given on the structure and organisational processes leading to these policies and the *described* role of foresight in this. Subsequently, a meta-analysis of a large dataset of security and defence foresights will be undertaken to examine what the *actual* role of foresight analysis is.

Chapter 3: Changing Defence Priorities United Kingdom and United States

3.1 Introduction

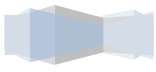
The purpose of this chapter is to describe how foresight analysis made its intrusion in U.K. and U.S. defence policy making. An attempt will be made to examine the extent to which foresight is actually part in this process and how this is reflected in the latest defence White Papers. Section 3.2 focuses on the concept of foresight within the British defence policy process. The background against which the last two White Papers were formulated is provided. Section 3.3 describes the structure of the U.S. defence policy process to examine what parties and factors have an influence on this. Finally, section 3.4 gives a literature overview of so-called 'evidence-based policy', so more insight can be gathered about the relation between scientific research and policy making. This is important to find out if and how foresight analysis that emerges out of the 'research world' is used as input for policy makers and how the practice of both worlds - in the case of foresight - reflects the theory about it.

3.2 The concept of foresight within the U.K. defence policy

Strategic Defence Review (1999)

Under the Labour government of Tony Blair, the U.K. defence and armed forces have played a large role in the pursuit of its foreign policy, with a strong emphasis on 'hard power'. From this view the "Strategic Defence Review (SDR)" of 1999 emerged, which also sought to reduce expenditure and improve efficiency (Chandler and Beckett, 2003). This review also highlighted the growing concern about the role the U.K. should play in the world and the hollowness of its defence capabilities. As a consequence, the SDR aimed to *"maintain and reinforce the present favourable external security situation"* (SDR, 1999). This review was based on the requirement that *"to move from stability based on fear to stability based on the active management of these risks, seeking to prevent conflicts rather than suppress them. This requires an integrated external policy through which we can pursue our interests using all the instruments at our disposal, including diplomatic, developmental and military. We must make sure that the Armed Forces can play as full and effective a part in dealing with these new risks as the old"* (SDR, 1999). Another important part within the SDR is the creation of 'defence diplomacy', in which the several existing tasks were put under one header[5]. The concept was broadened to stretch beyond defence issues in Europe with the notion of the U.K. to be a *"force for*

[5] '*Defence Diplomacy: Good Things Come in Threes'*, MoD Press Release No.367/99, 18 October 1999



good in the world", such as the peacekeeping mission in East Timor in 2003. The emphasis was also placed on joint capabilities so that under a Joint Task Force Headquarters, a rapid deployment overseas in combination with the management of simultaneous operations could be possible[6]. The government will therefore have a greater degree of flexibility and adaptability capabilities than it had before.

In the 1999 SDR, it is stated that in order to meet the changes of the future security environment, a clear long term view of the objectives and the contribution of defence to them must be provided (SDR, 1999, p.10). A time horizon to 2015 is considered to act as basis for the further restructuring of the defence architecture, meaning that the defence requirements should be as robust as possible in the coming 15 years. The inherent uncertainty of the future is acknowledged, but at the same time the importance to consider a wide 'scenario space' is recognised. Identifying emerging trends on a wide range of dimensions that could potentially have an impact on national security are therefore imperative in the requirement and procurement processes (SDR, 1999, p.15).

A "New Chapter" was added to the SDR in 2002 following the terrorist attacks on September 11th 2001 and responded to the challenges raised by the War on Terror. In the post-9/11 world, Blair argued that the U.K. has to remain in a type of state that focuses on both warfighting and peacekeeping. He stressed that the West is confronted by global terrorism and 'rogue states', which places new demands on the armed forces as they shift away from a focus on traditional conflicts to more unconventional ones[7]. An interesting element in this "New Chapter" is the recognition of concepts as '*agility*' and '*adaptability*' in order to be more "FAR" against a wider range of the potential 'scenario space' of threats (SDR – A New Chapter, 2002). British involvement in recent operations in Iraq and Afghanistan illustrate the kind of warfare to be reckoned with in the future: "*the phasing, scale and tempo may all differ from those of operations against a more conventional opponent*" (SDR – A New Chapter, 2002).

Delivering Security in a Changing World (2004)

The defence review issued by the U.K. government in 2004 was called "Delivering Security in a Changing World: Future Capabilities". In the former defence policies the focus was already on the deep uncertainty of a new and rapidly changing security environment characterised by a diversity of multi-centric threats (MoD White Paper, 2004). The main themes were the "*need to move towards more rapidly deployable expeditionary forces capable of addressing any potential threat across the*

[6] '*Robertson's Review: Modern Forces for the World*', MoD Press Release 172/98, 8 July 1998
[7] Tony Blair, 'Our nation's future – defence', speech given aboard HMS Albion, Plymouth, 12 Jan 2007

full military spectrum and in any location, and the need to co-ordinate the activities of the three Services more closely by pooling their expertise to achieve maximum operational effectiveness, while at the same time eliminating the duplication of resources" (MoD White Paper, 2004). The 2004 defence review builds on the SDR of 1999 and the SDR New Chapter of 2002. Deep uncertainty about the possible future security threats and the FAR principles still act as a basis for this review.

The use of a wide array of future research methods, a triangulation of data sources, a wide participation and mutual learning – hence *foresight* - is key in the assessment of the strategic context for the British armed forces. The methodology behind this assessment clearly reflects foresight analysis and is set out in the project 'Strategic Trends' performed by the Joint Doctrine and Concepts Centre (JDCC) of the British MoD. The JDCC is an integral part of the MoD and makes use of an approach characteristic to foresight, to develop a coherent view of the future security environment and assist the MoD in gaining an understanding of future threats, risks, challenges and opportunities[8]. Its mission is to (JDCC, 2003):

- "*Provide long-term conceptual underpinning for the development of future systems, doctrine and force development and contribute to the MoD defence planning process;*
- *Formulate, develop and review joint doctrine at the military-strategic, operational and joint-tactical level, co-ordinate single-Service tactical doctrine and provide the U.K. input to Allied and multinational doctrine;*
- *Lead the U.K.'s contribution in promoting doctrine for peace support operations, in conjunction with International Organisations, other Government Departments, Non Governmental Organisations and the wider international community.*"

The JDCC's 'Strategic Trends' project is therefore of major importance in the priority setting and doctrine set out in the actual defence review of 2004 and clearly shows the penetration of foresight as an approach in this endeavour. While in the former defence policies an time horizon to 2015 was used for the assessment of the future strategic landscape, 'Strategic Trends' takes it even further to 2030. Based upon particular drivers[9], current trends in seven dimensions[10] were identified and an attempt was made to explore the potential synergistic effects and interrelationships between these trends. Each dimension was thoroughly analysed in a series of workshops attended by relevant

[8] http://www.mod.uk/DefenceInternet/MicroSite/DCDC, accessed July 2008.
[9] In the study, a 'driver' is defined as: "[…] *a factor that directly influences or causes the change. Drivers can be direct or indirect*" (JDCC, 2003).
[10] These are: *Physical*, *Social*, *Science and Technology*, *Economic*, *Legal*, *Political* and *Military* (JDCC, 2003).

actors, ranging from field experts, the scientific community, government officials, policy analysts and business executives (JDCC, 2003). Obviously, the researchers also took account of so-called 'shocks'[11], which is an important part of future defence planning and needs be incorporated to meet the principles of FAR. In section 3.4, the future security threats for each dimension and a prioritisation thereof identified in this project will be further described.

Another sign of the increased penetration of foresight as a methodology for British defence planning is seen in a meta-foresight study done by the U.K. Defence Evaluation and Research Agency. In this study, a meta-analysis over 50 future studies was performed to identify key trends and drivers that might affect the U.K. policy baseline in the next decades. The intention of this study was "*to provide background material for subsequent PIU* [Performance & Innovation Unit of the Cabinet Office] *work and policy development in this area"* (DERA, 2001). The methodology they used has some characteristics similar to the approach chosen in this thesis, namely to conduct a sophisticated literature review and analysis over a rather large set of relevant foresight studies to extract and assess key drivers and trends for the long term future. The DERA acted as an input for policy makers by listing qualitative trends that form a "*relatively robust and comprehensive base from which to generate strategic scenarios or 'worlds' to inform policy development or to test strategy and plans*", making it part of the foresight approach embedded in British defence planning (DERA, 2001).

3.3 Structure of the U.S. defence policy

Background

After the end of the Cold War, U.S. military strategy needed to be reshaped in order to cope with new challenges. Several defence policies were produced, including the "Base Force" Structure, Bottom Up Review, the Commission on Roles and Missions (CORM). These policies were heavily criticised on various grounds, resulting in recommendations that the DoD should undertake a major quadrennial defense review in which the Chairman of the Joints Chiefs of Staff needed to develop a clear vision for future joint operations (Brake, 2001). Therefore, U.S. Congress formally established the so-called Quadrennial Defense Review in the National Defense Authorization Act of 1996, to help ensure the internal consistency of the medium and long(er) term defense planning and provide a blueprint for a strategy-based, balanced, and affordable defence program (Brake, 2001; QDR 1997). The QDR directs the DoD to undertake a wide ranging review of the force structure and military

[11] In the study, a 'shock' is defined as: "[…] *a high impact, low probability event. An example of a shock is: global collapse of financial system undermines confidence in capitalism*" (JDCC, 2003).

strategy, which is coherent with both the National Defense Strategy and the National Security Strategy. In Title 10, Section 118 of the U.S. Code it is specified that: "*The Secretary of Defense shall every four years, during a year following a year evenly divisible by four, conduct a comprehensive examination (to be known as a " quadrennial defense review") of the national defense strategy, force structure, force modernisation plans, infrastructure, budget plan, and other elements of the defense program and policies of the United States with a view toward determining and expressing the defense strategy of the United States and establishing a defense program for the next 20 years. Each such quadrennial defense review shall be conducted in consultation with the Chairman of the Joint Chiefs of Staff.*"[12] To be sure, the QDR is perceived as major important, not only because of the depth and breadth of the review, but also as the venue in which key defence issues will be decided (Correll, 2006).

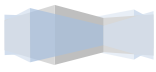
QDR Process

The QDR is a collaborative effort between the Office of the Secretary of Defense (OSD) and the Joint Staff, where the former is responsible for integrating the QDR effort and the latter will gather the data and formulate the inputs from the Military Services and the Commanders in Chief of the Combatant Commands into the end result. Although this process differs in some respects between the various QDRs, the basic QDR organisation is shown in the figure below (Brake, 2001; QDR 1997).

The QDR was structured into three organizational tiers or levels. At the first level, seven panels conducted reviews of strategy, force structure, readiness, modernisation, infrastructure, human resources, and information operations and intelligence. At the second level, an Integration Group organized the panel results into a coherent set of "integrated options" designed to be consistent with the defense strategy. At the third level, a Senior Steering Group, co-chaired by the Deputy Secretary of Defense and the Vice Chairman of the Joint Chiefs of Staff, oversaw the entire process and made recommendations to the Secretary of Defense, who, in turn, reviewed the recommendations in consultation with the Chairman and other members of the Joint Chiefs of Staff.

The QDR was designed to be both top-down and bottom-up. Top-down because the Secretary of Defense and Chairman of the Joint Chiefs of Staff guided the process and ensured that every phase was successfully completed and all decisions and alternatives provided the capabilities to execute the strategy. The process was also bottom-up, because the QDR tapped expertise and ideas from

[12] U.S. Department of Defense: http://www.defenselink.mil/qdr/



throughout the DoD and made use of additional ideas and support from beyond the DoD (QDR, 1997). This suggests an interesting and important role for (independent) think tanks, research institutes and alike, hence the entangled of the research world with the policy making world in the U.S.

The QDR 2001 was nearly completed before the 9/11 terrors attacks took place, which caused the DoD to amend it to make the war against terror more pronounced and making Homeland Defense a primary mission of armed forces. Pentagon officials did, however, confirmed that the strategic direction and planning principles of the QDR were still valid (Correll, 2006). The Bush administration established a new defence strategy, which resolved around the following critical goals: assuring allies that the U.S. is capable of fulfilling its commitments; dissuading adversaries from undertaking activities that could pose a threat to U.S. or allied interests; deterring aggression and coercion; and to decisively defeat any adversary of deterrence fails (QDR, 2001). The QDR particularly emphasised on a capability-based strategy, instead of the traditional threat-based strategy, in order to better prepare for a wide range of asymmetric threats and to balance many dimensions of risk. Rather than fixating on who the adversary might be or where a war might happen, this QDR would focus on "*the growing range of capabilities that adversaries might possess or could develop*" and which capabilities the U.S. itself might need (QDR, 2001).

In the 2001 QDR, specific attention is drawn to the role of uncertainty in assessing the future global security environment. Potential military threats, the future battlefield and the kind of attacks the U.S. should prepare for are hard to determine. Historically seen, unexpected changes, such as the collapse of the Soviet Union, can have a rapid and tremendous influence on the geopolitical landscape. Emerging technologies can revolutionise military competition and the nature of warfare, making the need for FARness in defence planning even more pronounced. In the 2001 QDR, this is acknowledged as follows: "*While contending with such uncertainty is a key challenge for U.S. defense planning, certain features and trends of the security environment define not only today's geopolitical and military-technical challenges but also highlight critical operational challenges that the Nation's armed forces will need to master in the future*" (QDR, 2001).

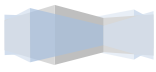
The QDR also proposed a new force structure that became known as "1-4-2-1", where '1' stands for *defending the homeland*; '4' is to *deter aggression in four critical theatres* (Europe, Northeast Asia, East Asian littoral, Middle East/Southwest Asia); '2' refers to *swiftly defeat aggression in any two theatre conflicts simultaneously*; and '1' means to *preserve the option for decisive victory in one of those theatre conflicts* (QDR, 2001). However, already in the 1990s and following a report of the *2000*

U.S. Commission on National Security in the 21st Century, military analysts called for a replacement of the two-MTW paradigm with a more flexible model as a basis for the force structure. In today's complex and various military contingencies, the DoD should not rely on a model that fails to produce the necessary capabilities to confront the changing security environment. Although the need to be more FAR was acknowledged in the 2001 QDR, the two-MTW model still acted as a basis for the military structure. In a review of the U.S. General Accounting Office (2002), it was stated that "*DoD's adoption of a new strategy and a capabilities-based approach to force planning as significant steps that should better enable defense planning to focus on future, rather than near-term, threats*". However, DoD's actual assessment of the force structure requirements had some important shortcomings, including "*the lack of focus on longer-term threats and the requirements for critical support capabilities*" (GAO, 2002). As a result, the DoD lacks assurance that the military is optimally structured to balance short and long term risks, and in what way existing military forces and weapon programs have to be adapted in response to emerging threats.

It is interesting to note that in the 2002 GAO review, the creation for a congressionally mandated advisory panel of outside defence experts preceding the next QDR was mentioned. This expert panel should identify key issues that might pose a threat to the U.S., which the DoD should then examine as part of its review. In assessing the future security environment and developing sound defense strategies based on that, officials of the Office of the Secretary of Defence (OSD) stated that they drew on a wide variety of sources, such as think tanks, (commercial) research institutes and government organisations. All these strategic – future oriented – reports were then collected in order to develop an initial paper to discuss these security issues (GAO, 2002). After this, the Secretary held various meeting with his top military as well as civilian staff to craft a solid defence strategy. The extensive use of strategic explorations from a broad range of sources and the involvement of both inside and outside defense experts in developing the defence strategy indicates the use of foresight. The participatory nature, future intelligence gathering and the medium to longer term strategic explorative process aimed at present-day decision making and policy formulation, shows that foresight indeed plays an important role in formulating the QDR.

3.4 The role of an 'evidence-based' approach in policy making

In this section, the use of scholarly research that feeds into the policy making process – 'evidence-based policy' – is touched upon, since the results of the meta-analysis of scholarly research studies



(i.e. the *foresights*) are compared with the eventual policy end-product (i.e. the *defence policies* of the United States and the United Kingdom). To get an understanding of the relation between both the "research world" and the "policy making world" in general, a brief overview of the existing academic literature on 'evidence-based policy' will be given.

3.4.1 'Evidence-based policy'

Within the academic literature there seems to be no clear-cut definition of 'evidence-based policy'. According to Young *et al.* (2002), the meaning is considered "*self-explanatory or is defined simply as the systematic appraisal and review of empirical research findings".* The term 'evidence-based policy' is based around two sets of related assumptions, "*one referring to the way in which policy is made, the other to the evidential nature of social science itself*" (Young *et al.*, 2002). Improved access to scientific information and to the hands-on experience of decision-makers has multiple benefits from the perspective of developing new management options and adaptive capacity. Rarely does research supply an 'answer' that policy actors employ to solve a policy problem. Research can provide a background of (empirical) data and ideas that affect the problem solving thinking of policy makers (Weiss, 1982). Often it helps them make sense of what they have been doing after the fact, so that they come to understand which courses of action have gone by default.

Kitson *et al*. (1998) and Edwards *et al.* (2001) argue that the all stages in the policy development process – identify and articulate problem, policy analysis, undertake consultation, move towards decisions, implementation and evaluation – should be visited when research findings are used in developing sound 'evidence-based policy'. However, the effectiveness of this depends heavily on the way the policy process *an sich* is organised and can be connected with researchers in a way that makes effective use of their knowledge and skills (Edwards *et al.*, 2001). Weiss (1979) argues that there is mutual interest in whether scientific research is 'used' to influence policy makers. She concludes that regardless of the deployment of research sources for mobilising policy makers, both worlds interact and are influenced by the larger fashions of social thought.

3.4.2 'Evidence-based policy' in public policy making

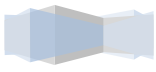
'Evidence-based policy' has become a major part of many governments' approaches to policy making and the machinery of government (Davies, 2004). However, as the famous economist John Maynard Keynes once quoted: "*there is nothing a government hates more than to be well-informed; for it makes the process of arriving at decisions much more complicated and difficult."* The extent to which scientific research is employed and integrated into government policy varies tremendously between

national administrations. Solesbury (2002) explains that the institutional structures and political culture of a country often determine the way research is used in policy making. For instance, the worlds of both the research community and policy makers are closely intertwined within the U.K., while in the U.S. these worlds are much more disconnected from each other.

Solesbury (2002) argues that "*at present, 'evidence-based policy' seems to be principally a British commitment*." A study performed by the OECD in 2001 revealed that although the issue of how research and policy making can better interact is debated in other countries, the actual concept of 'evidence-based policy' and practice is not as lively as in the U.K. The intrusion of the concept has yet to enter into political discourse in other European or North American states (OECD, 2001). However, the 2001 EC White Paper on 'Governance in the EU' states that: "*[…] scientific and other experts play an increasingly significant role in preparing and monitoring decisions. From human and animal health to social legislation, the institutions rely on specialist expertise to anticipate and identify the nature of the problems and uncertainties that the Union faces, to take decisions and to ensure that risks can be explained clearly and simply to the public*" (European Commission, 2001).

To reflect the intrusion 'evidence' made into the British policy making process, the 1999 White Paper policy document 'Professional Policy Making' – issued by the Cabinets' Office *Strategic Policy Making Team* – states that *"good quality policy making depends on high quality information, derived from a variety of sources: expert knowledge; existing domestic and international research; existing statistics; stakeholder consultation; evaluation of previous policies; new research, if appropriate; or secondary sources, including the internet"* (SPMT, 1999). In the context of its agenda for modernising public policy making, the U.K. government devoted even more effort into 'evidence-based policy' by issuing the 2000 White Paper 'Adding It Up', outlining how evidence-based policy could be more effective. Several government bodies published three additional documents to provide more insight into the value and use of 'evidence-based policy' within the broader context of modernised policy making (Nutley and Davies, 2003).

To conclude on this point, for policy makers, scholarly research is not the only source of evidence available. Almeida and Báscolo (2006) argue that research results have highly varied roles in actual policy formulation, the most effective perhaps being "*to change the 'terms of the debate' on a given issue, depending on the actors' political power of persuasion and their ability (using politics and lobbying) to keep the specific issue on the policy agenda over time and to implement the intended changes, as well as the issue's importance to a given society at a specific moment.*" To be effective as



possible, evidence needs to be provided by, and/or be interpreted by, experts in the field working closely with policy makers. The research – policy making nexus is complex due to numerous intervening variables (that can influence each other) in the decision making process, making it extremely difficult to assess to outcome of the interaction between the two 'worlds' (Nutley, 2003).

3.5 Current focus points in the defence policy of the U.S. and U.K.

In this section, the future risks, challenges and threats to the national security of both the U.S. as well as the U.K. will be outlined.

3.5.1 United States

The *2005 National Defense Strategy* formed the foundation for the 2006 QDR. The former calls for a continuous process in restructuring DoD's capabilities to address a wider range of challenges (NDS, 2005). Next to the predominance of the U.S. armed forces in **traditional** warfare[13], they also need to be better equipped to face new and asymmetrical challenges of the future. In the 2006 QDR, these challenges include (QDR, 2005, p.3; NDS, 2005, p.4):

- **Irregular challenges**: "*conflicts in which enemy combatants are not regular military forces of nation-states*". This is fuelled by both the rise of political, religious and ethnic extremist ideologies as well as the absence of effective governance in weak states;
- **Catastrophic challenges**: "*catastrophic terrorism employing weapons of mass destruction (WMD)*". This includes the relative easy access to information concerning technologies to make and use WMD or have WMD-like effects;
- **Disruptive challenges**: "*disruptive threats to the United States' ability to maintain its qualitative edge and to project power*". This is caused by adversaries that develop and use breakthrough technologies to pose a threat to U.S. dominance in key operational domains.

In figure 3.1, these priorities are clustered in an overlapping array of different types of challenges that threaten U.S. interest. In today's complex security environment, these challenges clearly overlap. Adversaries operating in one domain can possibly copy methods and capabilities from adversaries proficient in other domains and can potentially lead to an opponent capable of combining the capacities of all four challenges.

[13] "*Challenges that are posed by states employing recognized military capabilities and forces in well-understood forms of military competition and conflict*" (NDS, 2005).

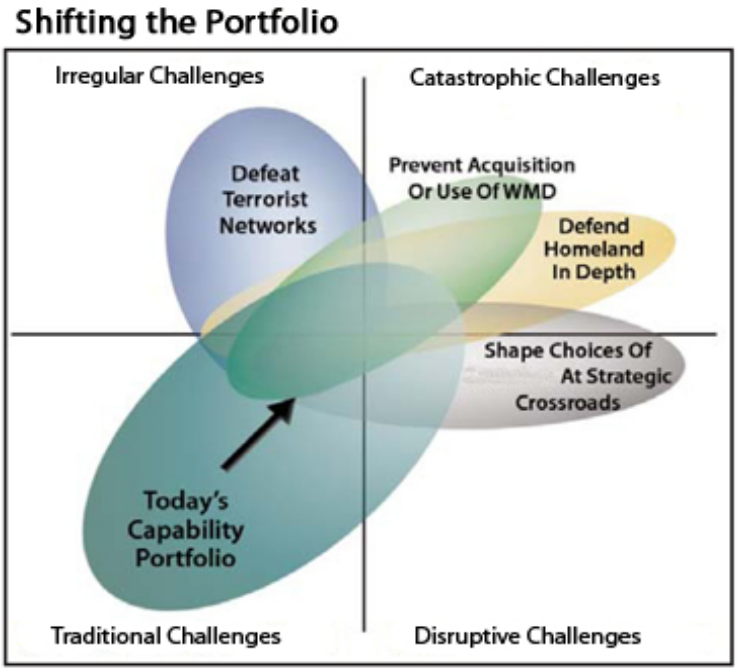


Figure 3.1: Shifting the portfolio of capabilities to address traditional challenges to also include disruptive, catastrophic and irregular challenges to U.S. interests. ***Source: 2006 QDR, p.19***

As can be observed from figure 3.1, the DoD's senior civilian policy makers and military leaders identified four priority areas from these challenge domains as the focus of the QDR (2005, p.19). At the same time a note is added to these 'priorities', stating that they "*clearly do not represent the full range of operations the U.S. military must be prepared to conduct, they do indicate areas of particular concern*" (QDR, 2005, p.3). However, with these focus areas the DoD attempts to increase the capabilities and forces, not only to be better able to deal with a wide range of challenges, but also to increase the "*overall adaptability and versatility in responding to other threats and contingencies*" (QDR, 2005, p.3).

In table 3.1, each priority area is marked with a **code** (i, ii, iii and iv). This code is convenient as the text mining results (which will also be given a code) and priority areas / security themes of the U.S. and U.K. are put in a cross-table for comparison.

Defeating terrorist networks	**i**
Defending the homeland in depth	**ii**
Shaping the choices of countries at strategic crossroads	**iii**
Preventing hostile states and non-state actors from acquiring or using WMD	**iv**

Table 3.1: Security areas & codes

3.5.2 United Kingdom

The Joint Doctrine and Concepts Centre (JDCC) is an integral part of the British MoD and "*provides the intellectual bases that inform coherent decisions in defence policy, capability development and operations, both now and into the future*"[14]. The JDCC essentially delivers the assessment of threats, risks and challenges that the U.K. and its armed forces may face within the next 30 years. It argued that a complex, strategic environment that changes faster than could be anticipate on is the greatest security risk faced by the United Kingdom (MoD White Paper, 2004). From their 'Strategic Trends' project, it followed that the trends that would have a direct impact on the security and defence policy process of the U.K. to the year 2030 are (JDCC, 2003):

Decline in state sovereignty and a shift of power from states to international or non-state networks	**1**
Increased destructive power of the asymmetric threat from terrorists and/or hostile states to U.K. homeland and overseas interests	**2**
Greater requirement for U.K. Armed Forces to operate in complex terrain, e.g. mountainous or urban areas	**3**
Increasing turbulence world-wide, with persistent low intensity threats	**4**
Proliferation of new technologies (e.g. biotechnology), which could be used by future adversaries	**5**
Likely new nuclear and WME power	**6**
Failing states becoming a greater threat to global security than resurgent ones; poorly governed space poses a threat as a safe haven and training ground for terrorist groups	**7**
Evolving politico-military alliances and coalition partnerships; various states will face strategic crossroads	**8**
Evolving North Atlantic/European security architecture; the U.K. is likely to find it increasingly difficult to satisfy both U.S. and EU political goals	**9**
The U.S.-declared 'global war on terrorism' and ongoing military transformation programme will significantly affect future U.S. concepts, diplomacy and global military footprint	**10**
Fundamentalist reaction to Western (particularly U.S.) power and culture	**11**
Increasing mutual antagonism between Islamic and Western cultures	**12**
Inter-state migration becomes a greater issue	**13**
Competition for scarcer natural resources	**14**

[14] http://www.mod.uk/DefenceInternet/MicroSite/DCDC, accessed July 2008.

Increasing calls for humanitarian intervention and assistance overseas (especially in sub-Saharan Africa)	**15**
New environments for conflict: space and cyberspace	**16**

Table 3.2: Security Trends & Codes
Adapted from the 'Strategic Trends Project', JDCC (2003)

Out of this extensive overview of trends that might impact U.K. security interests, a prioritisation of three themes is provided in the 2004 Defence White Paper:

International Terrorism	**v**
Proliferation of Weapons of Mass Destruction	**vi**
Failing States	**vii**

Table 3.3: Priority Security Themes & Codes

Next to this initial prioritisation of trends, the JDCC also included the key defence and security implications for each of the seven dimensions they covered, which are "Physical", "Social", "Science and Technology", "Economic", "Legal", "Political" and "Military" (JDCC, 2003). Besides, to prevent too much emphasis on the trends and easy conclusions, an additional list of potential "shocks" for each dimension is provided.

3.6 Conclusion

It becomes clear that with respect to the priorities stated in the 2006 QDR, these are so broadly formulated that one cannot really determine what the actual priorities are. The U.S. is often characterised as the 'world's police force' and it indeed seems that the politicians and policy makers at DoD have the ambition to defend itself, its allies and friends from an as wide spectrum of security threats as possible. Unsurprisingly, the military expenditure of the U.S. is by far the largest in the world[15], accounting the defence budget for nearly 45% of the world's total[16]. Obviously, this makes it hard to prioritise particular threat categories. To some extent it is quite logical to keep such priorities vague and broad - especially from a political point of view - and the inherent uncertainty in the assessment of future threats. However, a somewhat more specific threat categorisation and prioritisation would give a better indication of the consequences this has on the defence structure, processes and procedures to deal with this. Nonetheless, an attempt will be made to filter out the

[15] SIPRI military expenditure database (2008) at http://www.sipri.org/contents/milap/milex/mex_database1.html; World Military Guide (2008) at http://www.globalsecurity.org/military/world/index.html (2008)
[16] CIA World Fact Book (2007) at https://www.cia.gov/library/publications/the-world-factbook/rankorder/2067rank.html

issues that deserve most attention in the 2006 QDR and how this relates to the results found in chapter 5 of this study.

The limitations for identifying a clear threat categorisation and prioritisation observed in the 2006 QDR are less prominent for the 2004 Defence White Paper of the United Kingdom. For the same reasons as mentioned before, it is undoable to point out specific threats for particular time horizons. However, the security threat categories are more distinctive and the possible implications for the British national interests are more narrowly described as opposed to what is stated in the 2006 QDR. Based upon particular drivers, current trends in seven dimensions were identified and an attempt was made to explore the potential synergistic effects and interrelationships between these trends.
In chapter 5, the text mining results of the foresight exercises for the U.K. and what is stated in the defence review are compared to find overlap and differences.

Chapter 4: Methodology

4.1 Introduction

In this chapter, the methodology used in this study will be elaborated on. Essentially, this process can be described along the lines of three sequential modules:

(1) Foresight studies database: Various stages in this data collection process include the sources used, search criteria, pre-processing of foresight exercises before the text mining could begin and the analysis of the output (section 4.2);

(2) Text analysis: The idea behind the text mining application is to identify emerging issues that come up in future-oriented exercises and semantic clusters. The purpose of the former is to identify the increasing focus on particular themes that should be anticipated on for present policy formulation. The latter deals with identifying themes that are dominant within the population of foresight exercises, how do these themes change over time and how are they interrelated to each other (sections 4.3 and 4.4);

(3) Data visualisation: The raw data output from Text Analyst will be analysed with Tableau Software and subsequently visualised and interpreted (section 4.5).

This process is schematically pictured in the graph below.

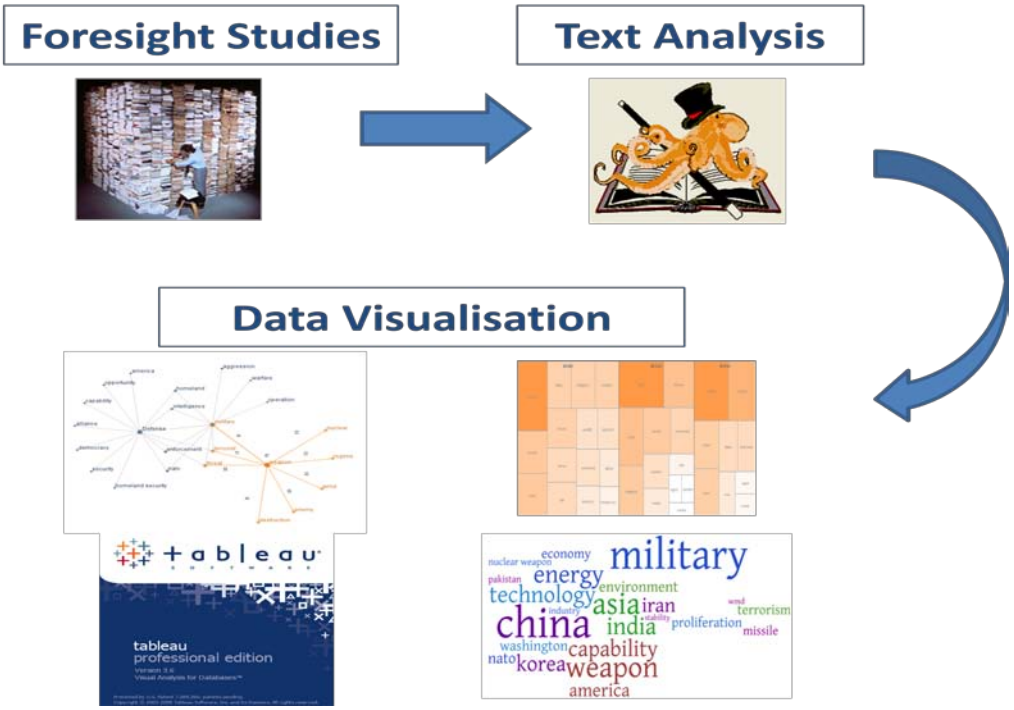


Figure 4.1: Methodology Process

In the next chapter, conclusions will be drawn with regard to the themes that are found as important according to the 'foresight community' in the field of security and defence and how this relates to what is deemed important in the defence policies of the United States and the United Kingdom.

4.2 The foresight database

According to Davis (2007) there exists no clear-cut theory about how to identify the appropriate set of scenarios, or, in this case, foresight exercises that should be part of the database. Instead, he proposes that this process should be described as following a set of tasks: *expanding*, *structuring*, *focusing*, *assessing*, and *constructing* (Davis, 2007). Below, the different stages to how specific security and defence related foresight studies are collected, is explained in four stages, thereby keeping in mind Davis' set of tasks.

Stage I

Via the internet, a search was done for foresight exercises which are available online and free of charge. The availability of so many full-text databases, an attempt was made to explore as many available full-text electronic sources as possible for the U.K. and U.S. in several different categories:

- *Search engines / open source*: via general search engines (mostly Google and Yahoo) particular search terms[17], were used to specifically focus on defence-related future-oriented studies, preferably available as a PDF-file for efficiency reasons;
- *Specific websites*: sites as the military portal of the Air War College (http://www.maxwell.af.mil) and of the International Relations and Security Network (http://www.isn.ethz.ch) – among many others - were particularly useful in finding serious defence-related foresight exercises;
- *Foresight databases*: HCSS foresight database, but also from EFMN and Dynamo;
- *Academic literature*: various databases of academic journals and university databases;
- *Official government documents*: the policy documents on the websites of the relevant ministries (U.K. Ministry of Defence; U.S. Department of Defense);

Stage II

The following criteria have been applied in the search for foresights:

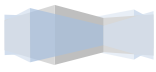
- Foresight exercises published from 1990 to 2004 for the U.K. and 2005 for the U.S., a period foresight exercises would most likely be incorporated in the last defence policies;

[17] For example: *("foresight" OR "future" OR "scenario" OR "scenarios") AND ("security" OR "Defence" OR "Defense") site:mod.uk -site:da.mod.uk filetype:pdf)*

- The meaning and significance of a foresight is dependent on the publisher's meaning of what constitutes a foresight. There is no fixed time horizon or prearranged criterion concerning the topic, sector and content in order to prevent biased results;
- The scope may be national or global, preferably national (U.K. or U.S.);
- Publications may originate from a variety of sources, including government, NGOs, research institutes and corporations.

It is important to note that there is a clear distinction between the way foresight is used as a *method* for present day policy making *and* how future-oriented studies define themselves as being foresight. Some future-oriented studies define themselves as foresight, while others are just stand-alone studies that try to forecast are foresee how a particular future might occur. However, if in the latter case, these studies are used by a third party – in this case the U.S. and U.K. defence policy makers – these studies automatically become part of the foresight method according to the definition of foresight given by the EC Handbook on Foresight (2002): *"Foresight can be defined as a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilizing joint actions. The term 'foresight' therefore, represents the processes of focusing on the interactions among science, technology and society.*"

This means that the original purpose of the particular future-oriented study might not be for present day policy making, but when policy makers use it nonetheless *and* in a systematic, participatory manner, the study becomes part of the *foresight process* used by these policy makers. Since it is stated in both the U.S. as well as in the U.K. defence policy that future-oriented studies from various sources are used to formulate present day policy making, the process itself has all the characteristics of foresight. Hence, although some of these future-oriented studies do not define themselves necessarily as a foresight study, they do are put in the foresight database provided that they are based on broad participation and have a medium to longer term time range. This will obviously make it a rather large and broad database, containing a wide range of various foresight studies. This part of the inventory process is called "*expanding*" (Davis, 2007), where the purpose is to expand the evidence base as much as possible. During this stage an attempt is made to identify anything that might make a difference in determining courses of action (the L factors in the XLRM framework of Lempert, Popper, and Bankes, 2003) or relationships (R factors). This way the pitfall of missing potentially important things is minimised.



In the next step, the foresights are "*structured*" in a database so that the major analytic dimensions that characterise the evidence base can be determined (Davis, 2007). Identifying foresights that should go into the database and mapping them according to several dimensions are mainly manual efforts. The present amount of **204** foresights for the U.S. and **123** for the U.K., which have been found according to the abovementioned methodology, have been put in an excel document (see Appendix A). Of each foresight, the following information has been registered:

- *Search trajectory*: title, where, when, search term
- *Inventory*: source, type of organization, year of publication, time range, key words, language

Figure 4.2 displays a bar chart showing the yearly distribution of the analysed foresight studies for respectively the U.S. and the U.K. Appendix B gives an overview of various cross-sections (pie charts) of these datasets.

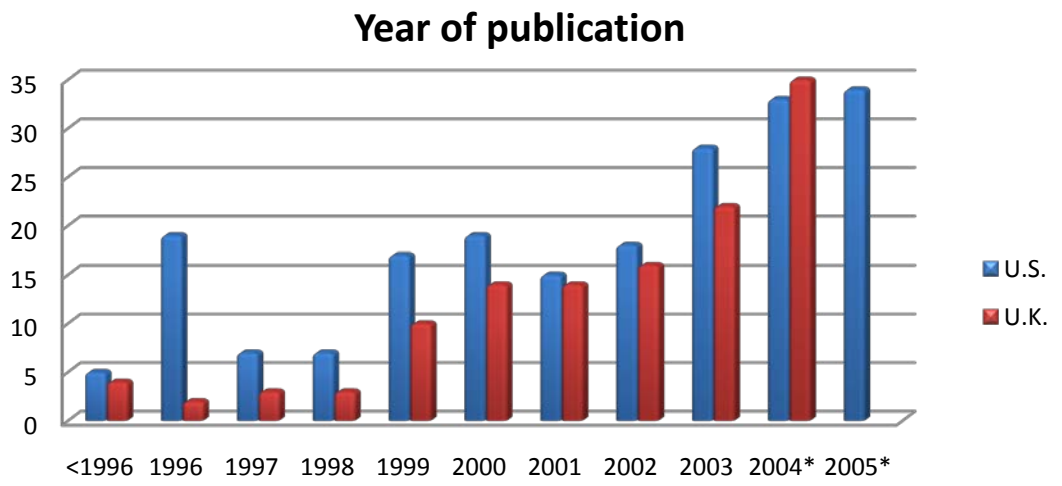


Figure 4.2: Distribution year of publication. *Foresight studies in this year were collected prior to the release of the Defence White Paper, so these could, theoretically, been taken into account.

Stage III

The foresight exercises from the abovementioned sources had to go through a pre-processing stage before they could actually be handled by Text Analyst. First, a long list of foresight exercises was made in which a so-called semantic threshold was used to decide which foresight exercises should be part of the actual analysis. This threshold was set at 35, meaning that the semantic weight of the terms "defence" and "security" (or "defense" for U.S. foresights) had to be in order to be included in the database. For details about semantic weight and assigning semantic scores to terms, please refer to section 4.3. This threshold was determined by calculating the average score of the terms "**defence**" (or "**defense**") and "**security**" over the population foresights of heavily related security and defence-foresights (obvious from the title or abstract), medium-related security and defence foresights (looking at the abstract or scanning the foresight), and non-related security and

defence exercises (defence or security was not regarded as important in title, abstract or in total document). This threshold is found by "trial-and error" in an iterative manner and seen as useful to separate the wheat from the chaff. This way an attempt is made to mitigate the misbalance between 'important' and 'unimportant' foresight exercises for the final analysis. Stage III is called the task of "*focussing*" (Davis, 2007), where the purpose is to maintain coherency and comprehension, so that the database is "pure" in the sense that it contains specific security and defence related foresight studies.

Stage IV

The preparatory and automated work is not intended to replace, but rather to assist the analyst. In the last stage, an intelligent analysis of these pre-processed datasets needs to be performed. Here, the "assessment" and "constructing" tasks come in (Davis, 2007). The assessment task is where the terms with a high semantic weight and their co-occurrence with other highly important terms are assessed, in order to identify and filter out the specific themes that require a further in-depth analysis. Finally, in this analysis, the strength of these themes in relation to a 'security basket'[18] of terms (including *risk*, *security*, *threat*, *disaster* and *catastrophic*) is assessed, in order to determine to what extent these themes are important to terms within this 'security basket' and can potentially form the foundation for the defence policies of the U.S. and U.K. The text mining results of the two countries are analysed and explained in the following sections.

4.3 Text mining

Hearst (2004) defined *text mining* as "*the discovery by computer of new, previously unknown information, by automatically extracting information from different written resources*". Text mining is often confused with data mining, and although they are quite similar, they do differ on some accounts. Most importantly, text mining tools can work with unstructured or semi-structured data (e.g. HTML files, full-text documents, e-mails), while data mining tools are designed to handle structured data from databases or XML files. In table 4.1, the differences between text- and data mining are explained (Trippe, 2005; Spinakis and Chatzimakri, 2004).

In analysing the security and defence related foresight exercises, a specific text mining software programme was used. With the use of this text mining module, it becomes possible to identify patterns and relationships between emerging issues on the basis of a systematic dataset much larger

[18] See section 5.3.3 for an explanation of the 'security basket'.

than can humanly be processed. The added value of text mining is that it allows for a genuinely systematic comparison across countries. Too many international comparisons are done as descriptive parallel analytical exercises with very little systematic comparability. Text mining, on the other hand, minimises the various (conscious or unconscious) biases that frequently occur in such parallel exercises. This chapter describes the rationale behind text mining, its functions and its implications for policy analysis as well as the process of data-gathering. In section 4.3, the use of the text mining software program Text Analyst and the basic idea of the scoring process are addressed. Lastly, in section 4.4, the problems encountered with this tool and the way to deal with these is explained.

Text mining	Data mining
Relies on unstructured or semi-structured data	Relies on fielded (structured) data
Term extraction takes place based on semantic based algorithms	Involves numerically based statistical analysis
Documents containing overlapping concepts can be organised together	Allows for temporal analysis
Documents containing overlapping concepts can be placed together partially	Clustering based on coding
	Involves co-occurrence matrices and histograms

Table 4.1: Text mining vs. Data mining

As a result, text mining is a much better solution for this study, where large volumes of diverse unstructured and semi-structured foresight exercises must be merged and managed. For example, for the *Project National Security*, TNO/HCSS analysed over 2000 future foresight exercises for the Dutch government to create a long list of future developments that could be related to vital interests of the Dutch society. The amount of data was so substantial that it could not be humanly processed within the set time frame and therefore the help of text mining proved very useful. However, obviously computers are not capable of comprehending natural language as humans do, in the sense of dealing with spelling variations, slang, applying and distinguishing linguistic patterns and contextual meaning. Nonetheless, although our language capabilities allow us to understand unstructured data, text mining software has a main advantage in analysing such data: they can process text in large volumes and at high speed (Fan et al., 2005). Therefore, the key advantage of text mining is to combine the linguistic capabilities of humans with the speed and accuracy of computer technology.

4.3.1 Functions of text mining

Text mining tools automatically extract texts for qualitative information, for instance by means of the appearance of words in the text. The technique resembles the functioning of spam filters, which also scan large databases of text and attach a qualification (spam/no spam) on the basis of the appearance of words. Yet modern text mining tools are able to do much more than just scanning for statistical appearance of words. There are many technologies that can be used in text mining, but keeping in mind the objective of this study, the most important are (Fan et al., 2005; Spinakis and Chatzimakri, 2004; Stathopoulou, 2005):

- *Information extraction*: identifying key terms, phrases and relationships within a text by looking for predefined sequences in a text ("pattern matching"). This is the most obvious functionality of text mining of forms the basis of most other functionalities discussed below;

- *Semantic networks*: concept linkage by identifying commonly shared concepts and connections between these concepts ("neural network of concepts") and help users find information that they perhaps would not have found using traditional searching methods. In examining epidemic threats, for example, this functionality makes it perhaps possible to identify links between diseases and treatments when humans cannot (especially when dealing with large volumes of texts);

- *Categorisation*: identifying the main themes of a document by placing the document into a pre-defined set of topics. Categorisation often relies on a thesaurus for which terms are predefined and put in a 'basket' of similar terms. By looking for such similar terms, synonyms or related terms, relationships between them can be identified. This makes it possible to examine which particular 'baskets' (for example an 'energy basket' or 'health basket') become more relevant over the course of time. Also, most text mining tools have a method to rank documents under a particular topic, as to see which content is most related to that topic. Policy analysts use taxonomies to categorize and conceptualize the matters they are investigating. The modus of categorisation is often contested and the individual analysts' bias affects how a certain issue is categorised. Using text mining software, it is possible to generate new and support existing taxonomies through a similarity analysis of the semantic networks of concepts (tree structures) across a number of texts. This way some concepts that occur to have a relationship with a each other in different texts are distilled and tagged under the same taxonomy;

- *Summarisation*: if a user wants to know whether a lengthy document is worth reading or meets it needs, the functionality of text summarisation can be extremely helpful. Such a text summarisation software process takes about the time a typical human would read the first section. The key to summarisation is to reduce the length and detail of a document while retaining its main points and overall meaning. To make a summary more readable and intelligible, not only sentences, but also newly constructed phrases can be added to the summary. This way a user can quickly assess the relative importance of the text to the topic they are interested in.

4.4 Text Analyst

Text mining is a 'young' but quickly growing discipline. The key to selecting a good text mining tool is finding a company that markets the technologies that meet your needs. A number of software packages are on the market, but given the needs of this study, a decision was made to use an 'in-house' product TNO/HCSS decided to develop and expand: the Russian software package **Text Analyst**. In the last year, additional modules and functionalities to this software package were developed, which is based on a semantic network approach[19]. Text Analyst makes it possible to import and transform huge amounts of structured and unstructured data into a structured semantic database. Analogous to algorithms used for text analysis in the human brain, mathematical algorithms inside Text Analyst determine which terms and combinations of terms – co-occurrence – are most important in the context of a text by analysing their connections to other concepts in that text (see Appendix C for a detailed description of these processes). Text Analyst implements a variety of analysis functions based on utilising an automatically created semantic network of the investigated text.

4.4.1 Semantic network of Text Analyst

Text Analyst generates the most important concepts in a text based on semantic weight of these concepts and determines the semantic strength of the relationships between these concepts (see figure 4.4 for a graphic depiction). The results can be exported to excel or xml-files. In addition, TA creates a HTML-structure which shows the most important terms and the sentences in which these terms figure.

[19] At the time of writing, the Russian software developer is still incorporating new features to make the product applicable for many other users.

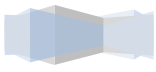
In doing so, Text Analyst creates the semantic network without needing any background knowledge of the subject.[20] The resulting semantic network is thus a set of the most significant concepts distilled from the analysed texts. Each concept is assigned a numerical semantic weight, which is defined as the probability that this concept is important in the studied text. The key advantage of Text Analyst compared to other text analysis and information retrieval systems, is that it is able to distil the semantic network of a text completely autonomously, without prior development of a subject-specific dictionary by a human expert. The user does not have to provide Text Analyst with any background knowledge of the subject, as the system acquires this knowledge automatically.

4.4.2 Methodological issues

For each article, Text Analyst produces a list of terms with semantic weights. As explained before, mathematical algorithms inside Text Analyst determine the relative importance of a concept by analysing its connections to other concepts in that particular article. The salience of a particular term is established through a calculation of the cumulative semantic weight (CSW) of the term by Text Analyst. The CSW is the *sum of all semantic weights that the term has scored in texts in which it was statistically relevant*. CSW, then, reflects upon both the importance of a term within a context as well as on its salience within the overall discourse. After all the foresight exercises have been analysed, Text Analyst creates long lists for both countries of the statistically relevant terms based on their CSW.

When it comes to comparing results across country datasets, CSWs pose several methodological problems. Large datasets automatically produce higher CSWs for the terms deemed important for the purpose of this study. These terms are called '*proxy-terms*'. For example, 'energy' is a proxy-term for terms as 'nuclear energy', 'fossils', 'energetic', etc. Proxy-terms are also a mean to find terms that are derived from this proxy-term. For example, the proxy-term 'crim' is used as a suffix for 'criminality', 'crime', 'criminal', etc. Mostly, Text Analyst does this automatically for verbs, but in this case these proxy-terms also cover nouns and word combinations. Comparing the CSWs for different countries is somewhat problematic, simply because they are based on different numbers of texts. The country dataset of the U.S., for instance, comprises more foresight exercises than the dataset of the U.K. This would mean that, in comparing the CSWs of the proxy-terms of these two countries, the U.S. would have higher CSWs on all these terms. In addition, the size of the database varies by year and by country depending on the number of publicly available foresight exercises that could be

[20] Tutorial: Text Analyst Introduction. Text Analyst 2.32v. © 2004 MicroSystems, Ltd.



accessed. With regard to the cross comparability of the results across countries and across time, several methodological problems were thus encountered to which different solutions were found.

- **Cross comparability of the results**: the CSWs were only regarded as a method the find terms with the highest score, disregarding the score *an sich*. For example, let's say the term 'terrorism' has the highest CSW in both the U.S. and U.K. However, this CSW is much higher in absolute terms in the U.S. than in the U.K. (due to a misbalance in the representative amount of foresight exercises). This does not mean 'terrorism' is more important in the U.S. as opposed to the U.K., rather, 'terrorism' is seen as the most important term in both countries. The CSWs of all terms (within their respective U.S. or U.K. foresight population) are thus determined in order to find terms with the highest scores on which the rest of the analysis should then focus.

- **Too many terms**: after Text Analyst has analysed a foresight exercise it generates a long-list of terms (amounting to over a 1000 per text, depending on the size of the text). However, many terms are more or less related to each other, e.g. "terrorist", "Bin Laden", "Al Qaeda" can all be put under the same header of "terrorism". Therefore, these terms had to be categorised into several baskets of terms (or themes), so the weight of particular themes could be determined. These themes could then be prioritised and be compared with the priorities of themes showing up in the defence policies of the U.K. and U.S. Filling these baskets with terms requires the researcher to be extremely cautious. One approach that was taken was to take a text on a particular theme, "terrorism" for instance, and then look at all the related terms Text Analyst came up with and could be put in the basket of "terrorism". In the follow up, every term in this basket is recognised as one of the theme "terrorism", making it easier to calculate the overall score of the theme "terrorism".

- **Prioritisation of terms**: to determine if a term is really relevant for the purposes of this study, a so-called 'security basket' was created. The idea is that an assessment should be made whether terms with a high CSW show a relevant connection with terms in this 'security basket'. The composition of terms in the 'security basket' is chosen on the basis of an assessment of the CSW these terms had within the foresight population. It followed that these terms have the highest CSW in comparison to other security-related terms, such as 'danger', 'challenges', etc. Since we are only interested in finding the most powerful relationships of terms connected to this 'security basket', it suffices to take the following terms to include in the 'security basket': *risk*, *security*, *threat*, *disaster* and *catastrophic*).

- **Creation semantic network of terms:** the semantic networks of the interrelationships between the themes needed to be determined. However, the semantic network around, for instance, the theme "terrorism" is different in text A than in text B. Due to mathematical limitations in Text Analyst, these semantic networks could not be merged to create an average semantic network of "terrorism". This could only be done if the texts in which a theme occurs are analysed as one text. This means that these texts need to be merged as one and then be run through Text Analyst. The output will then show the semantic relationships between certain terms and subsequently between themes, hence the disentanglement of themes and how they are interrelated. Since it is very interesting to examine the development of the foresight discourse over the years, this merging process was done for every individual year.

4.5 Data Visualisation

After the foresight studies have been analysed with Text Analyst, the output has to be 'managed' in a comprehensive way. Long lists of terms with semantic scores attached need to be clustered and filtered down to meaningful proportions, hence need to be given 'content'. In order to do this in an efficient, fast and orderly fashion, the data analysis program Tableau Software is used[21]. To support the analytical process for the researcher, the final output needs to be visualised. For this purpose, several visualisation methods are used:

- Network Diagrams
- Treemaps
- 'Wordles'

4.5.1 Network Diagrams

As described in 4.4.1, Text Analyst has the capability to generate scores of the semantic relationship structure between terms. To comprehensively grasp this in a visualisation, a so-called network diagram is used. For example, in the illustration of Figure 4.4, the semantic network of some terms within the text mined *2002 United States National Security Strategy* is visualised. The network structure of the parent 'weapon' is highlighted. This should be interpreted as follows: the parent 'weapon' has a semantic weight of 97 in the entire text and a relationship with its subordinate

[21] Tableau © 2008 is a software product suite for visual analysis and web-based analytics (www.tableausoftware.com, 2008).

'nuclear' with a semantic weight of 22. It also shows that the term 'terrorist' is a common term in each of the networks of the parents 'Defense', 'military' and 'weapon'.

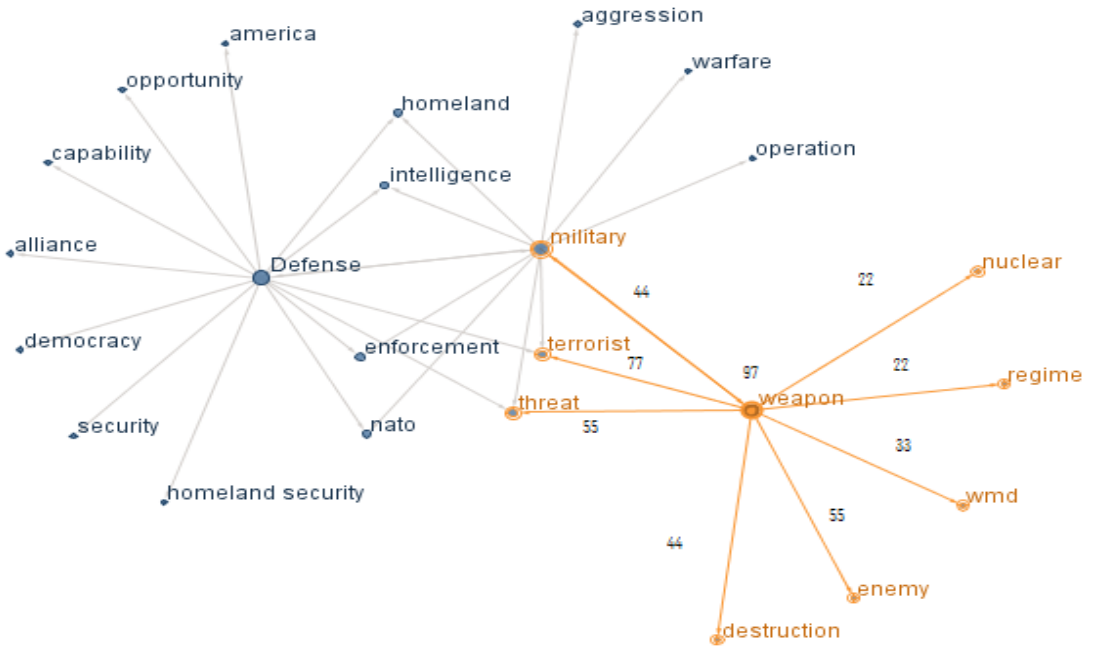


Figure 4.4: Graphic illustration of semantic networks formed by Text Analyst

4.5.2 Treemaps

In figure 4.5, a treemap of the same data as in 4.5.1 is shown. Such a treemap is very useful when one wants to analyse trends over time, to identify upcoming issues or visualise the importance of term within a 'basket' of similar terms. The size of a term box indicates the relative weight it has

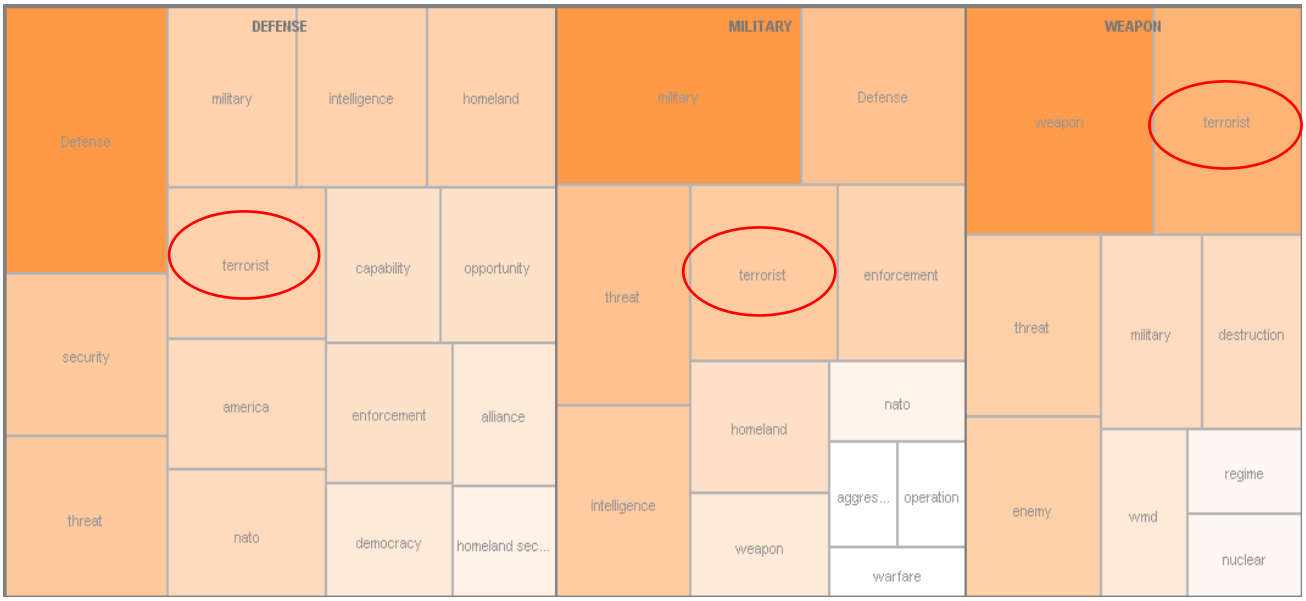


Figure 4.5: Treemap of terms in the 2002 United States National Security Strategy

within a particular basket and the colour indicates the strength of the trend of this term through

time. By clicking on different years, one can see the development of a particular term and its relationship structure with other terms over time. For example, in fig. 4.5 it can be observed that in the left box ('Defense'), the term *terrorist* was significantly more important than for instance *democracy* (the box 'terrorist' has a brighter colour and is larger as opposed to the box 'democracy'). This type of visualisation will be used further in chapter 5, when the development of the neural network of words linking to a particular theme has to be examined.

4.5.3 'Wordles'

'Wordles' enable you to see the 'strength' of terms in a given text – determined by either frequency or semantic weight. In the example below, a 'Wordle' was made of the *2002 United States National Security Strategy*. The size of a term is proportional to the quantity associated with that term, in this case frequency[22]. Although the text used in the example was not filtered for stop words or less meaningful words, it gives an idea of how data output can be visualised in a more meaningful manner than merely long lists of terms. In this study, 'Wordles' are used to get better insight in the terms and their importance relating to a particular theme and sub themes.

Figure 4.6: 'Wordle' of the 2002 United States National Security Strategy

[22] http://manyeyes.alphaworks.ibm.com/manyeyes/page/Wordle.html (2008)

Chapter 5: Results

5.1 Introduction

In this chapter, the results of the text mined foresight studies and defence policy documents will be provided. In 5.2, the terms that showed the highest semantic scores throughout the foresight discourse are shown along with the broad categories where they could be put in. Subsequently, the text mining results and initial prioritisation of important terms (after being analysed by Tableau Software) of the U.S. dataset and U.K. dataset are shown. In 5.3, the results will be visualised in network diagrams to make the interrelationships between various terms more insightful. Themes that are deemed important within the foresight discourse are then prioritised. In 5.4, the text mining results of the defence policy documents will be discussed and compared to the threat categories mentioned earlier in section 3.5. Finally, in 5.5, all the results will be compared to check for overlap and / or differences and some general observations are provided.

5.2 Text mining results

After all the individual foresights were text mined, the terms with the highest semantic weight within each foresight were selected (thereby accounting for duplicate terms) and put in the categories as shown below. These terms are regarded as most important - highest semantic weight - within the pool of foresights and with regard to the 'security basket' of terms. The categories where they were put in are only indicative and meant to bring 'order' in the long list of terms.

Security & Defence:

Adversar; Aerospace; Aggress; Al Qaeda; Alliance; Army; Asymmetric; Attack; Battlefield; Battlespace; Biological; Catastroph; CBRN; Chemical; Crim; Cris; Critical Infrastructur; Danger; Defence; Defense; Deterren; Disaster; Disruption; Emergency; Enemy; Extremism; Fragile state; Homeland; Insurgency; Insurgent; Islam; Jihad; Military; Missile; Nuclear; Piracy; Prepared; Proliferation; Radicali; Radiological; Risk; Rogue State; Safety; Security; Smuggle; Space; (Non)State actors; Taliban; Terror; Threat; Violence; Vulnerab; Warfare; Weapon; WMD

States / Regions:

Iraq; Iran; Europ; America; United States; (North) Korea; Asia; Chin; India; Russia; Saudi; Middle East; Israel; Somali; Arab; Pakistan; Afghani

Energy:

Energy; Oil; Emission; Uranium; Radiation; Plutonium; Gas; Nuclear energ;

Health:

Health; Disease; Pandem; Epidemic; Vaccin; Virus; Immunizat; Influenza; Plague; Drug; Infecti; Sanitation; Toxic; Zoonotic; Enzyme; Anthra; Pathogen

Nature & Environment:

Climat; Environment; Temperatur; Biodiversity; Dioxide; Ecosystem; Greenhouse; Natur; Pollut; Deforestation; Wetlands; Plantation; Acid; Desert; Deteriorat; Deplet; Scarc; Shortage; Resource; Mineral; Flood; Extinction; Agricultur; Food; (Mal)nutrition; Africa; Forestry; Water; Irrigation; Rural; Drought

Science & Technology:

Nano; Cyber; Internet; Digital; Biotech; Science; Technolog

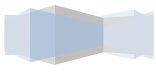
Social Issues:

Migrat; Global; Demograph; Poverty; Urban; Refuge; Religi

As explained in section 4.3.3, proxy-terms are used to find the specific terms related or that are derived from a proxy-term. In the category **Security & Defence**, for example, the proxy-term 'adversar' covers both the term 'adversary' as well as 'adversaries'. To narrow down the amount of terms given in the boxes above, the cumulative semantic weight (CSW) of each term within the larger population of foresights was calculated. The results of this initial prioritisation of important terms are discussed in the following sections.

5.2.1 Prioritisation of U.S. text mining results

With regard to the U.S. dataset, the cumulative semantic weight (CSW) of each term within the larger population of foresights was calculated and pictured in figure 5.1.



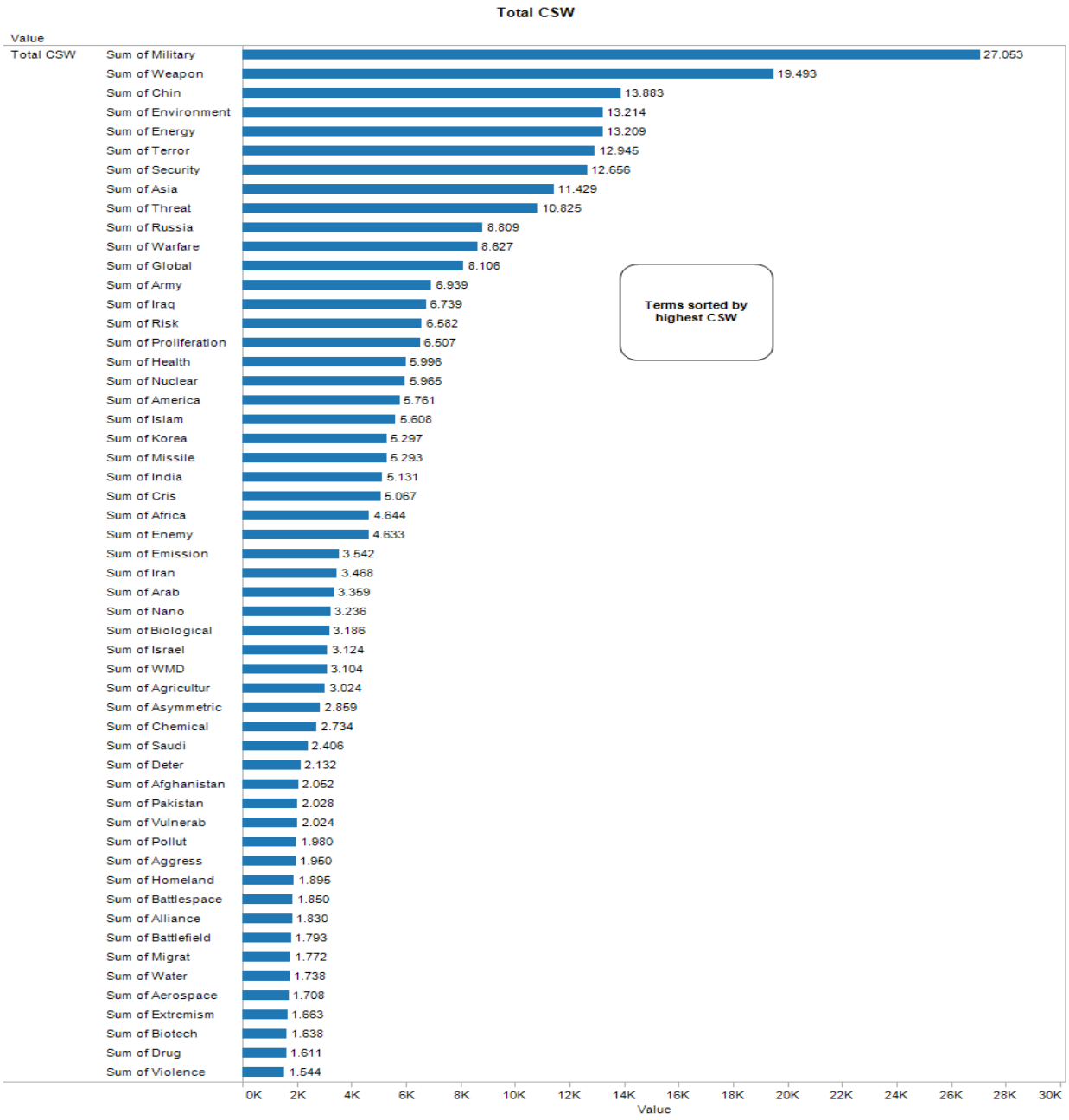


Figure 5.1: Terms in U.S. dataset showing a higher CSW > 1500

It can be observed that the over the entire population of foresights terms as “military”, “weapon”, “Chin” (which is a proxy-term for both ‘China’ and ‘Chinese’), “environment”, “energy”, etc. scored highest. Of course the CSW does not give a proper estimate of the real semantic value of a term within the foresight pool, since it is calculated on the basis of the amount of underlying foresights (the more foresights, the higher the CSW). Therefore, the average semantic weight of each term is calculated by dividing the CSW by the total amount of foresights in the population (n = 204).

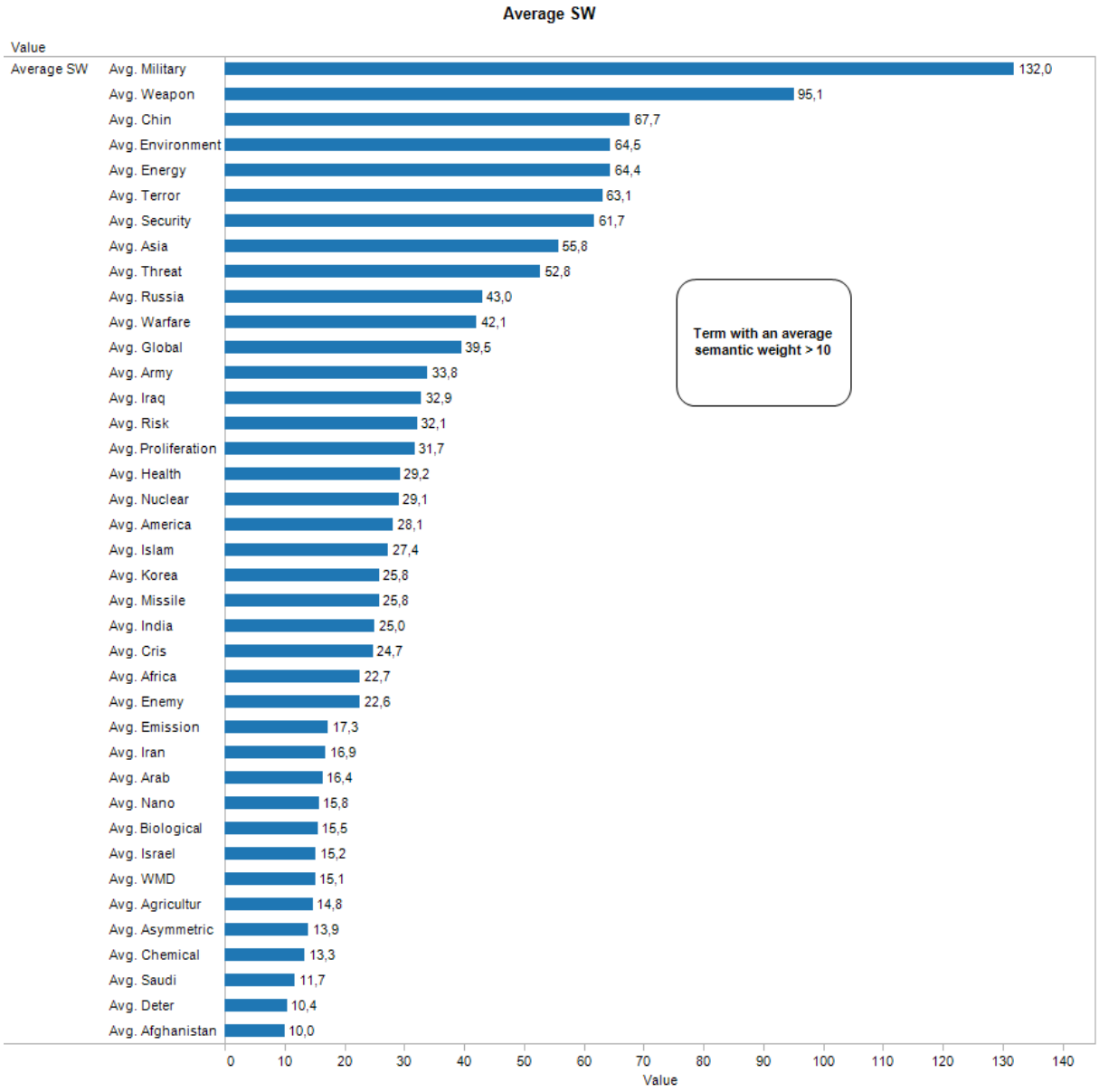


Figure 5.2: Terms in U.S. dataset showing an average semantic weight > 10

It should be noted that the average semantic weight of a term should not be necessarily < 100, because the term proxy-term "military" also includes term combinations like 'military expenditure', 'military modernisation', 'military doctrine', 'paramilitary', etc.

5.2.2 Prioritisation of U.K. text mining results

The same procedure as with the U.S. results was followed with the U.K. dataset and the terms with the highest CSWs are shown below (with a threshold CSW > 1000).

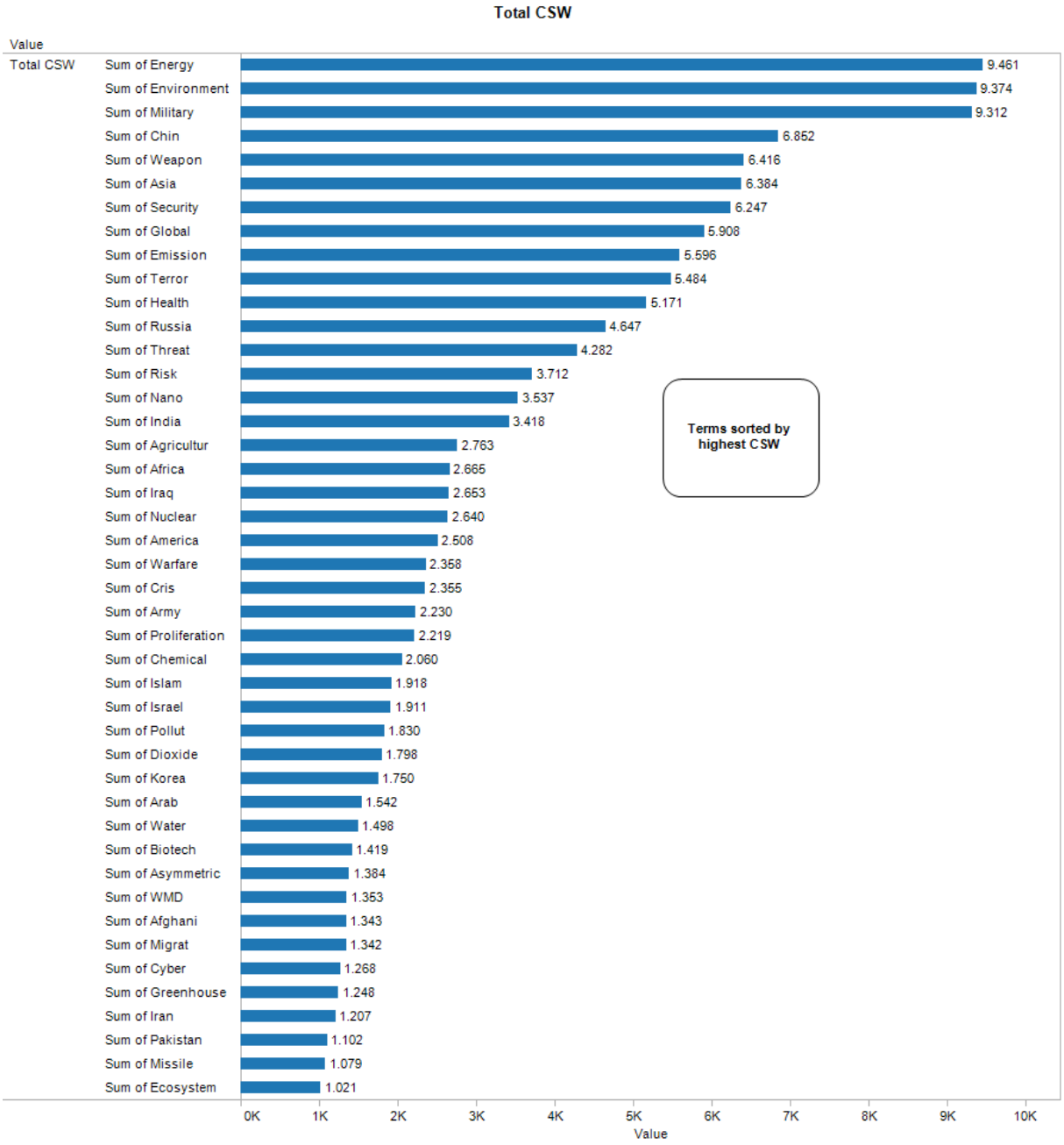


Figure 5.3: Terms in U.K. dataset showing a higher CSW > 1000

In comparison with the U.S. results, the U.K. results obviously show lower CSW for the same terms since the amount of foresights used in the U.K. analysis (n = 123) was less than for the U.S. (n = 204). To make these results more comparable, the average semantic weight for each term is calculated as well (see figure 5.4).

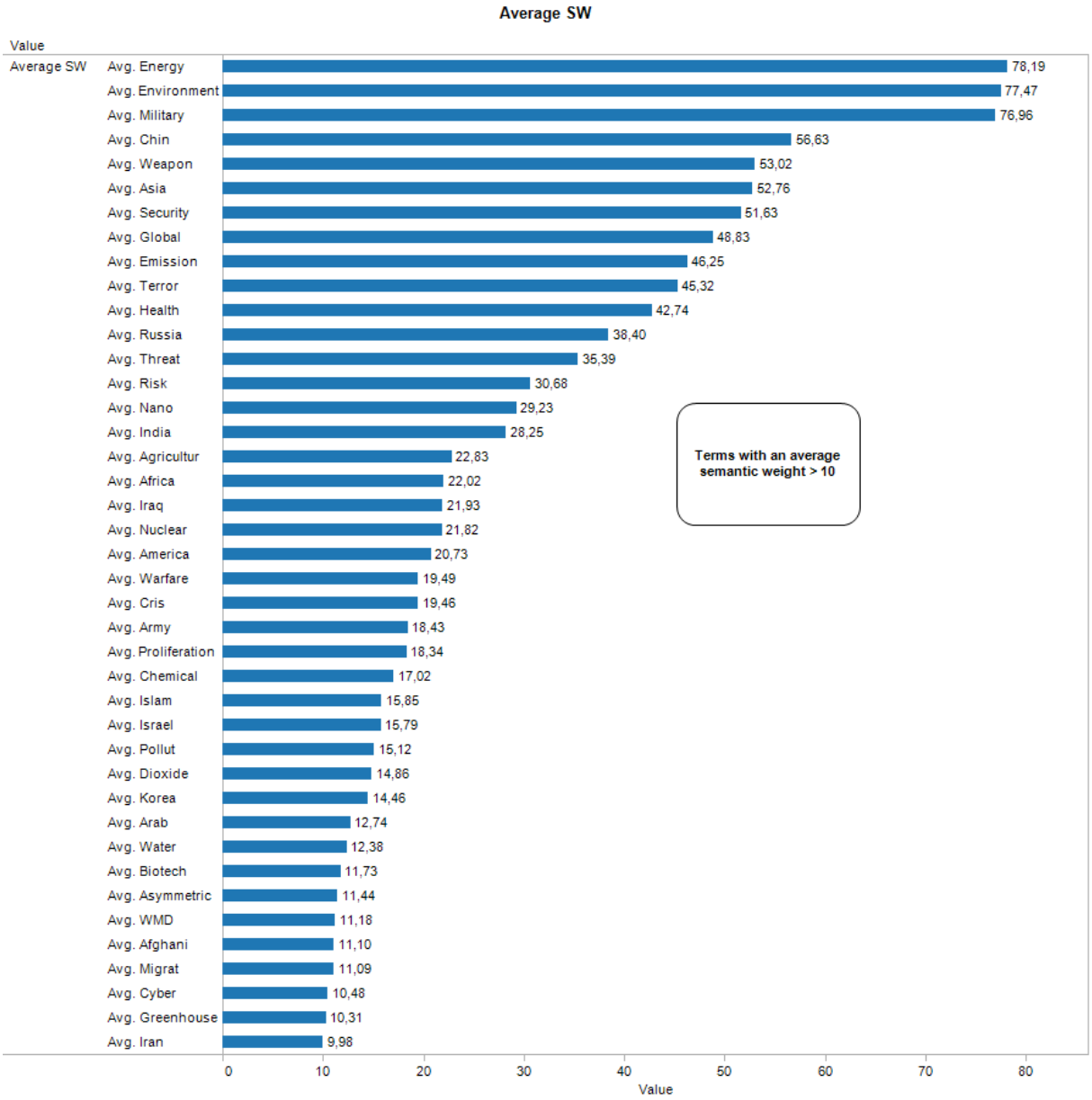
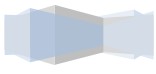


Figure 5.4: Terms in U.K. dataset showing an average semantic weight > 10

5.2.3 Initial observations

Some important observations can be made in comparison to the U.S. text mining results. Although the composition of the top segment does not differ that much, the scores sometimes do. Notice that the term 'energy' has an average semantic weight of 78 in the case of the U.K., for the U.S. this lies fourteen points lower (64). The same accounts for the term 'environment': in the U.K. results this has an average score of 77, while the U.S. this is just over 64. With respect to the term 'military', this has an average semantic weight of 132 in the U.S. dataset, but only 77 in the U.K. results. The same goes for a term like 'health': for the U.K. the average score is nearly 43, while the U.S. results show a score



of only 29. The most interesting results between the two countries are shown in table 5.1. The top segment of both countries are more or less composed of the same terms, albeit in a somewhat different order of appearance, based on the average semantic weight score. Thus, it can be observed that although the top is composed of more or less the same terms, the U.S. results indicate a higher score for the somewhat 'hard' issues - *military*, *weapon*, *terror*, *army*, *warfare*, *missile* etc. - in comparison to the U.K. results. With regard to the 'softer' issues - *environment*, *energy, emission*, *health*, *dioxide*, *agriculture*, etc. - it is the other way around, showing higher scores for the U.K. dataset.

Term	Average SW U.S. results	Average SW U.K. results
Military	132	77
Weapon	95	53
Chin	68	57
Environment	64	77
Energy	64	78
Terror	63	45
Security	62	52
Asia	56	53
Threat	53	35
Russia	43	38
Warfare	42	19
Global	40	49
Army	34	18
Iraq	33	22
Risk	32	31
Proliferation	32	18
Health	29	43
Nuclear	29	22
America	28	21
Islam	27	16
Korea	26	14
Missile	26	9
India	25	28
Cris	25	19
Africa	23	22
Enemy	23	7
Emission	17	46
Iran	17	10
Arab	16	13
Nano	16	29
Biological	16	6
Israel	15	16
WMD	15	11
Agricultur	15	23
Asymmetric	14	11
Chemical	13	17
Saudi	12	5

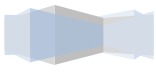
Deter	10	2
Afghani	10	11
Pollut	10	15
Dioxide	6	15
Water	9	12
Biotech	8	12
Migrat	9	11
Cyber	7	10
Greenhouse	4	10

Table 5.1: Comparison of the terms with the highest CSW for both countries; highlights in red / green show significant higher score for U.S. / U.K. dataset

5.3 Neural network of terms

Now that the initial prioritisation of specific terms for both countries is known, the relationship structure between the terms *and* with the terms of the 'security basket' for each respective country needs to be depicted. In the network diagrams, the so-called 'neural networks' of intertwined terms are visualised. To be part of this network, several assumptions and filtering steps were made:

- The terms in the 'security basket' acted as *parent* terms, meaning that for each term it needs to be assessed whether it has a semantic relationship with terms of the 'security basket'. If not, it is not regarded as an important *security* topic;
- A term becomes part of the network when its relationship structure with the 'security basket' has a semantic weight of ≥ 20. There exists no clear-cut threshold to determine when to include a term in the network or not. The chosen threshold of 20 is considered to be low enough to include all the relevant terms and high enough to separate the wheat from the chaff, i.e. to get rid of meaningless stop words, names, verbs and nouns, such as 'elv', 'ciis', 'thought', 'accordance', etc.;
- In the next filtering step, terms are removed that are not directly stop words, but more non-descriptive terms that does not have a clear value for further analysis, such as 'organisation', 'administration', 'system', etc.;
- To be included in the final stage, the remaining terms needed to show up in (1) at least three of all the years covered or (2) showing an increasing trend over the years or (3) having a score ≥ 20 in the year prior to the publication of the defence policy White Paper;
- The results of this process are visualised in so-called network diagrams (see below), where terms are connected to each other in the form of a node and link diagram. This way the overlap between terms and relationships becomes visible. One can say that the denser a part



of the network is – meaning more relationships with other terms outside and inside the 'security basket' – the more important these terms are within this area.

5.3.1 Relationship structure U.S. text mining results

In this network diagram for the U.S. text mining results, all the terms that met the criteria stated above are shown.

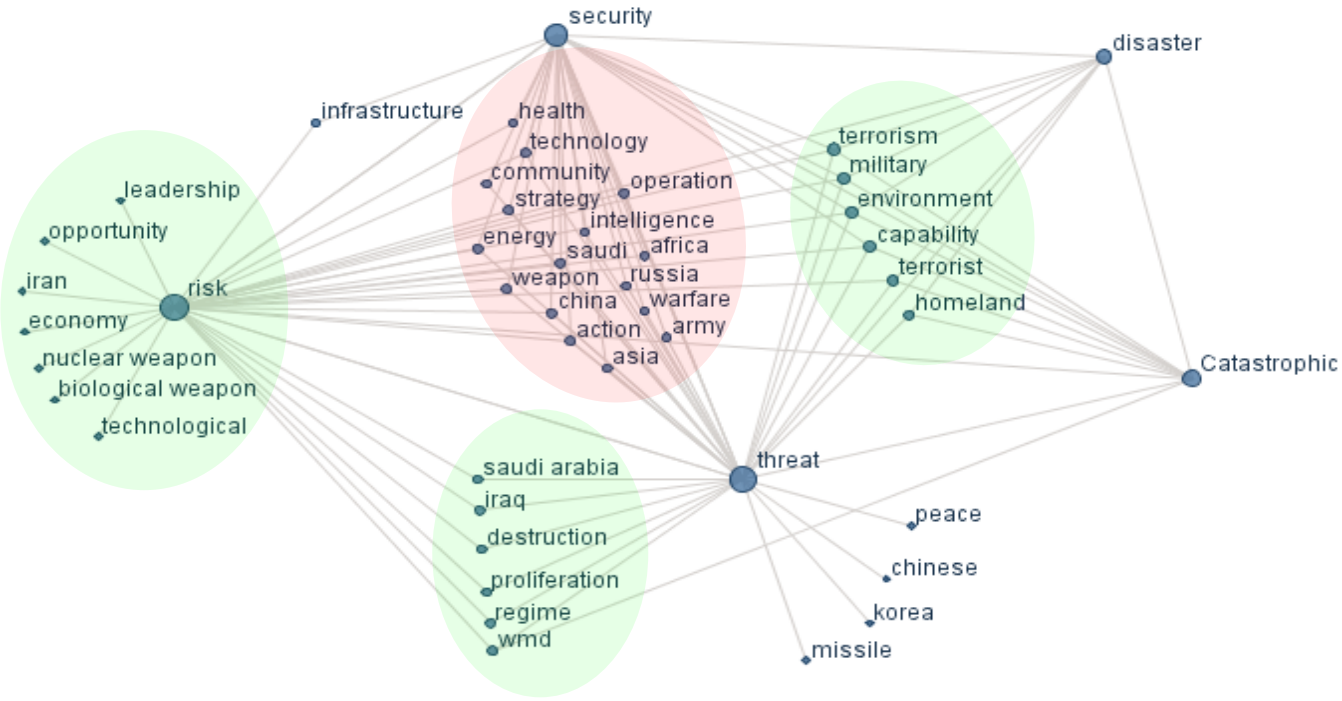


Figure 5.6: Network diagram U.S. results

Figure 5.6 shows a wide range of terms in the red oval, meaning that these terms are connected to at least three terms of the 'security basket' and are therefore *highly relevant* as a security issue. There is also a wide range of terms in the green ovals, meaning that these terms are connected to two terms of the 'security basket' and can be regarded as *relevant* security issues. The remaining terms are also important, but not real focus areas. The terms found here need to be compared to the terms showing a high average semantic weight in figure 5.2. Terms having a significant overlap in both figures *and* that are themes *an sich*, are the ones regarded as most relevant within the foresight population.

In the data analysis and visualisation program Tableau Software the relationship structures between these themes and terms surrounding them, are assessed according to the same logic as explained in 5.3. This is necessary since terms as 'proliferation', 'WMD' and 'nuclear weapon' (in the green ovals)

can all be clustered under the proxy-term 'weapon', but also under the proxy-term 'technology' (both in the red oval). It is, therefore, imperative to make a clear distinction between themes (on a more abstract level) and 'stand alone' terms – albeit a lot of terms show relations with different themes. By using treemap visualisations, the relative importance of each theme and connecting term over time can be observed. From this analysis follows that the priority themes in the U.S. dataset are (in decreasing order of importance):

1. **Shifting Power Structures**, i.e. the rise of China and Russia as fast growing economical and military powers, the role of the Middle East, in particular oil producing and 'risk state' Saudi Arabia, that causes increasing geopolitical tensions;
2. **International Terrorism**, i.e. increased adaptivity and capability of terrorists;
3. **Proliferation Advanced Technology and Mass Destructive Weapons**; i.e. proliferation of chemical, biological, radiological, nuclear and explosive (CBRNE) weapons;
4. **Changing Nature of Warfare**, i.e. the rise of urban and asymmetric warfare and military capability of China in particular;
5. **Energy Security**, i.e. power politics by countries with large oil and gas reserves, resulting in increased effort on technological advances for self sufficiency of energy and increased tension for conflict;
6. **Fragile States**, i.e. strategic importance of Iraq and Afghanistan, and threat coming from North Korea;
7. **Homeland Defence**, i.e. intelligence capabilities to protect against security threats.

These themes need to be compared with themes stated in the 2006 QDR and receive further attention in the section 5.5, where a cross-table will provide a comprehensive overview of all the different results.

Theme descriptions: 'Wordles'

It should be noted that it falls beyond the scope of this research to extensively describe every theme in detail. Instead, the aim is to provide a basic, short overview of its discourse within the population foresight studies. Although some themes are more specific than the themes described in the U.S. and U.K. defence policies, they are still rather broad. Therefore, the underlying drivers and connected sub topics that define the main themes – found by using Tableau software and the neural network diagrams – are used as well in these descriptions. For each of the themes 'Wordles' were used to enable the researcher to see the strength of terms in a given text - in this case the foresight studies -

or see the relationship between a set of terms - in this case in relation with the 'parent' term. These can be found in Appendix D.

5.3.2 Relationship structure U.K. text mining results

In this network diagram for the U.K. text mining results, all the terms that met the criteria stated in 5.3 are shown.

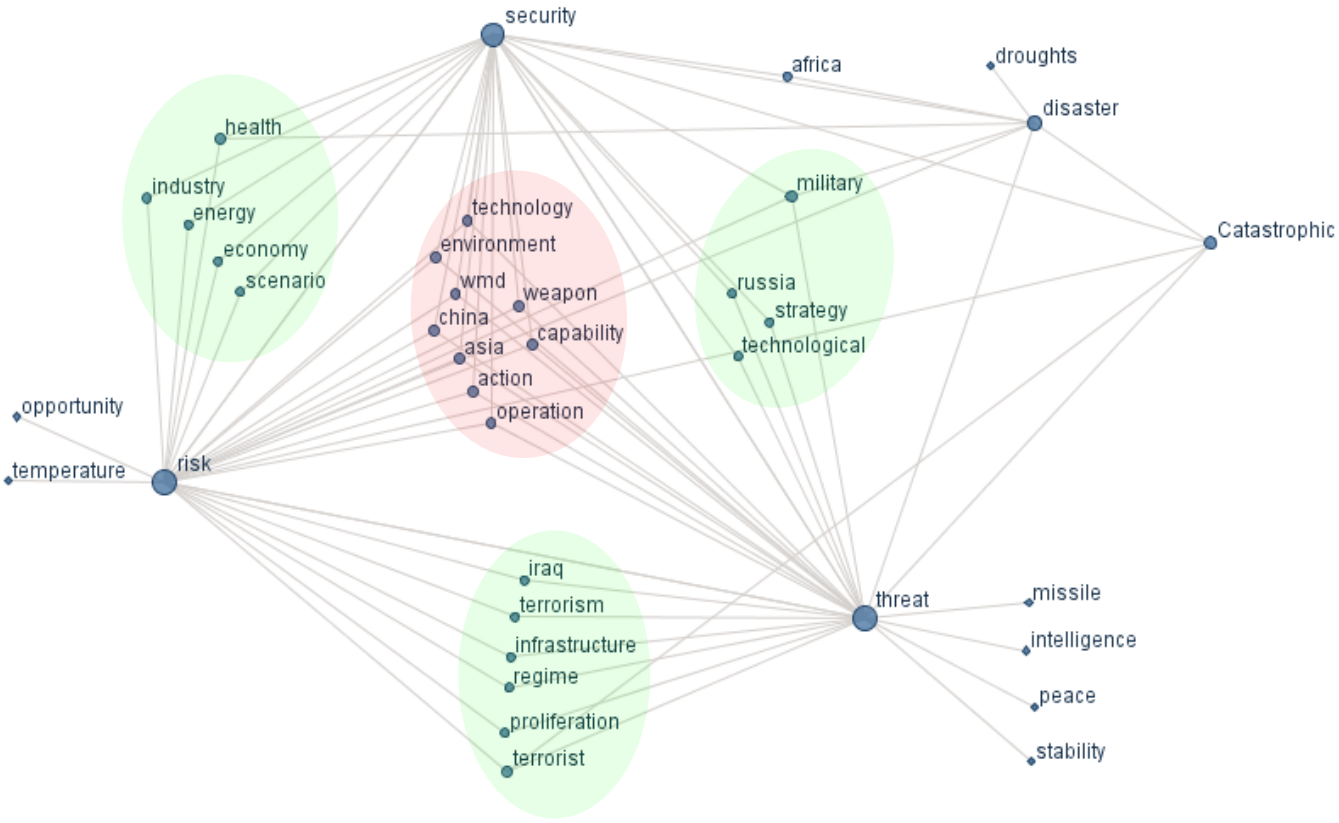


Figure 5.6: Network diagram U.K. results

Overall, it is clear that the network is less dense and focuses on somewhat 'softer' terms compared to the U.S. network diagram. Nonetheless, the terms showing up in the red oval are quite similar, i.e. 'China', 'weapon', 'technology' and 'environment' occur in relation to at least three terms of the 'security basket' and are regarded as *highly relevant*. In order to know on what themes further analysis should be conducted and how this relates to the themes stated in the British defence policy, the same logic is followed as with the U.S. results. These are (in decreasing order of importance):

1. **Shifting Power Structures**, i.e. the rise of China of Russia in particular;
2. **Energy Security**, i.e. power politics by countries with large oil and gas reserves, resulting in increased effort on technological advances for self sufficiency of energy and increased tension for conflict;

3. **Nature & Environment**, i.e. global climate change affecting ecosystems and harming natural environment;
4. **Proliferation Advanced Technology and Mass Destructive Weapons**, i.e. proliferation of CBRNE weapons;
5. **International Terrorism**, i.e. increased adaptivity and capability of terrorists;
6. **Fragile States**, i.e. strategic importance of Iraq, Afghanistan, and a state amidst a fragile region - Israel;
7. **Health Issues**; i.e. albeit a somewhat a 'weak signal', the *low probability – high impact* danger of pandemics, zoonotics and infectious diseases can be of serious threat to vital security interests;

On the basis of the 'Wordles' provided in Appendix D, the core text structure surrounding a particular theme – and sub theme – can be indicated. In section 5.5, all the results are put in a cross-table and compared with each other to identify overlap and/or differences.

5.4 Text mining results defence policy documents

The purpose of this section is to provide text mining results of policy documents used as input for the final defence policy. Since access to such documents has been problematic, only the publicly available policy documents were used. Although the defence priorities are clearly stated in both the 2006 QDR and the 2004 Defence White Paper, it is still useful to text mine other policy documents which are closely linked and even provide a basis for the final defence policy.

- For the U.S., these documents are the *National Military Strategy* (2005), the *National Defense Strategy* (2005), the CRS Report for Congress on the QDR process (2001) and the *QDR 2005*;
- For the U.K., these documents are JDCC *Strategic Trends* (2003), DERA's *Strategic Futures Thinking* (2001), MoD's The Future Strategic Context of Defence (2004) and the 2004 Defence White Paper *"Delivering Security in a Changing World"*.

5.4.1 U.S. policy documents

Figure 5.7 depicts the neural network of the text mined U.S. policy documents. The results show considerable overlap with the themes as stated in the QDR 2005, which also indicates a 'proof of concept' of the text mining tool. Terms as "terrorism", "homeland", "proliferation", "WMD", "asymmetric warfare" and "non state actors" are also highlighted as priorities – albeit in somewhat

different terminology – in the U.S. defence policy. Still, it is hard to deduct more specific threat categories deriving from the rather abstract security and defence issues as described in the QDR 2005. Since the latter covers such a large security spectrum, the real comparison with the text mined results is troublesome.

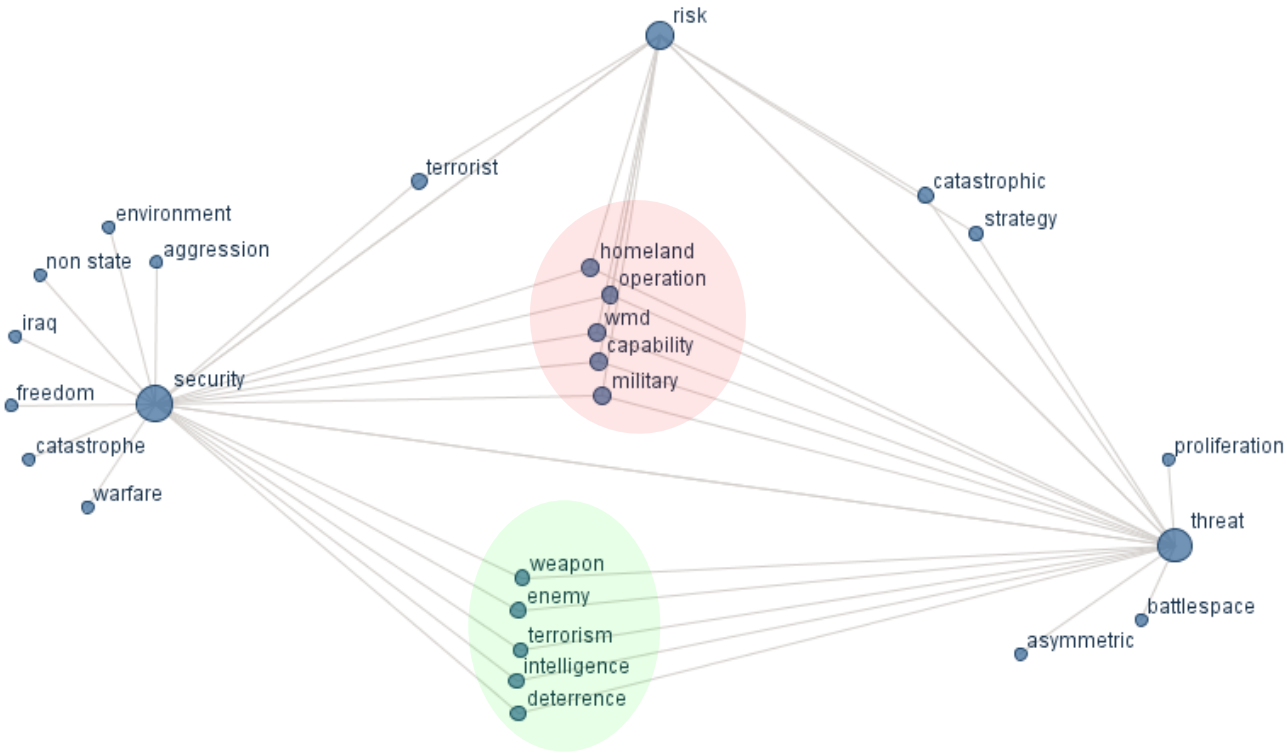


Figure 5.7: Network diagram U.S. policy docs

5.4.2 U.K. policy documents

As described in section 3.5.2, the British defence policy describes a much broader range of possible threat categories. Although the premises are still rather general – “International Terrorism”, “Proliferation of Weapons of Mass Destruction” and “Failing States” – an extensive overview of trends that might impact British vital interests is provided. The results of the text mined policy documents are pictured in figure 5.8 and reveal similar themes as these described in the 2004 White Paper. Terms as “alliance”, “NATO”, “EU”, “proliferation”, “WMD” and “terrorism” came out of the text mining analysis as (highly) relevant and correspond with the long-list trends stated in the 2004 White Paper. Overall, the validation of the text mining results with the actual content of the defence policy shows the ‘proof of concept’. However, the themes that are formulated more specifically in the defence policies have been used as referents for further analysis.

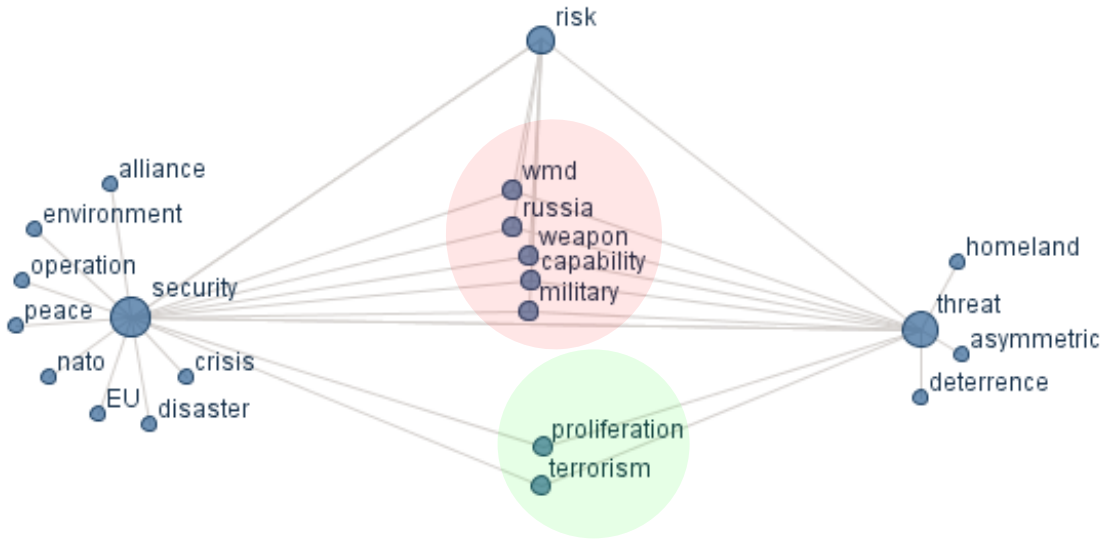


Figure 5.8: Network diagram U.S. policy docs

5.5 General observations

In table 5.2 the text mining results of the U.S. and U.K. dataset are shown, i.e. the themes that emerged out of the security and defence foresight discourses for both countries are compared with each other and with their respective defence policy priority themes. As mentioned, the themes identified as important within the foresight discourses are also rather broadly formulated and often cover several sub-themes. For example, the theme 'Proliferation Advanced Technology and Mass Destructive Weapons' can be subdivided in themes as 'the proliferation of new technologies (e.g. nano- and biotechnology)', 'increased threat by adversaries to use more destructive power', 'preventing adversaries from acquiring WMD' and 'rise of new nuclear and WME power'. It should be noted that it is unclear to what extent differences in terminology used for the themes and priority areas is a matter of linguistics – or 'semantic bias' – or actual difference in terms of content[23].

Results United States dataset:

In general, the results are pretty much in line with the four security priority areas as spelled out in the 2006 QDR. As was already visible in Table 5.1, the U.S. predominantly focuses on the 'hard' military issues, i.e. fighting terrorism, proliferation WMD, changing nature of warfare, hostile states, etc. With regard to the top-level issues that came out of the text mining analysis, two of the four QDR priority areas were reflected in the 'top-3'. However, an important observation is that a theme as 'Shifting Power Structures' (priority number one according to the foresight discourse) was not

[23] E.g. where the Americans can sometimes exaggerate in the use of terms ("War on Terror"), the British use the same terms in other, more 'modest' variations ("Campaign against terrorists").

explicitly part of one of the four QDR priority areas. It entails the role of China and Russia – amongst others – as emerging global powers that have consequences for the geopolitical landscape of the future. In the same vein, a theme as 'Energy Security' (in some ways closely linked to 'Shifting Power Structures') cannot be put under one of the four priority areas, while it is an important future issue.

	U.S. Themes				U.K. Themes																
Themes Foresight Discourse	i	ii	iii	iv	v	vi	vii	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Shifting Power Structures								x							x								
International Terrorism	x				x				x														
Proliferation Advanced Technology and WMD				x		x				x		x	x										
Changing Nature of Warfare*																	x						
Energy Security																					x		
Fragile States			x	x			x							x									
Homeland Defence*		x																					
Nature & Environment**																				x			
Health Issues**																							

Table5.2: Cross-Table Text Mining Results

*Thematic areas 'specific' for the U.S.; **Thematic areas 'specific' for the U.K.

The QDR priority areas 'Homeland Defence' and 'Shaping Choices for Countries at Strategic Cross-Roads' is covered as well, albeit as least important of the top-level themes. It should be noted that the latter themes has more to do with fragile countries like Iraq, Afghanistan and North Korea than with upcoming global powers as China and Russia (as in the case with the theme 'Shifting Power Structures'). Thus, due to the rather general nature of the thematic categories the QDR priority areas are well covered within the foresight discourse. However, areas as 'Shifting Power Structures' and 'Energy Security' were not part of this and can be regarded as separate security themes that should have been part of the security portfolio of the U.S.

Results United Kingdom dataset:

The results are to large extent coherent with the security themes and strategic trends stated in the U.K. 2004 Defence White Paper. From Table 5.1, it followed that the British focus was more on 'soft' issues rather than 'hard' issues, i.e. higher semantic weights for environmental and energy associated terms, also in comparison to the U.S. The three priority security themes of the 2004 Defence White Paper are included in the top-level themes as identified within the foresight discourse. Especially the theme 'Proliferation Advanced Technology and Mass Destructive Weapons' is reflected in at least one priority theme and three strategic trends. Themes as 'Nature & Environment' and 'Energy Security' are only partly touched in the long list of strategic trends, which is quite odd, since these are deemed as most important future issues for the U.K. and the list already covers much more issues than stated in the U.S.' QDR. It is also interesting to see that a theme as 'Health Issues' was not picked up as a key strategic trends by the JDCC, while it is included in the top-level security themes within the foresight discourse. However, since this is rather *high impact-low probability* threat contingency, it is mentioned as a potential "shock" category in the 2004 Defence White Paper. The text analysis of the foresight discourse, however, fails to identify particular issues that were stated as strategic trends, i.e. dealing with North Atlantic/European security architecture, clash between Western and Islamic cultures, humanitarian intervention in Africa and space and cyberspace as new conflict areas (coded as 4, 9, 11, 12, 15 and 16). Although some are pinpointed as sub areas within (sub) themes (e.g. the 'Wordle' for China does show a relation with 'space', albeit small), they have not been identified as top-level important security issues.

Chapter 6: Conclusions and Recommendations

6.1 Main conclusions

In the today's fast changing, increasingly complex security environment, the way to approach the future should be dealt with differently. Foresight analysis has become increasingly important in the strategic planning process, whether in the technology realm, business environment, policy making world or security and defence domain. The main goal of this study is to answer the following research question:

"In what way is the discourse of publicly available security and defence related foresight studies reflected in the security priorities as described in the U.S. and U.K. defence policies?"

In the first part of the study, an extensive overview of the foresight literature was given. This had the purpose to display the development of foresight analysis, its use in various domains and why it is important in the present-day security and defence environment. The FAR-principles of Flexibility, Adaptivity and Robustness are highly valued as well as the integration of foresight into the strategic planning process. Subsequently, the structural characteristics of the defence policies of the U.S. and U.K. provided more insight into which elements have an influence in the policy process. It should be noted that the defence priority areas were formulated very briefly, in particular in the 2006 QDR, making it difficult to distill concrete threat contingencies and compare these with the more specific text mining results.

In addition, it proved very difficult to determine in what way results from the 'research world' actually feed back into the policy making process. As was described in chapter 3, the extent to which scientific research is employed and integrated into government policy varies tremendously between national administrations. The research – policy making nexus is complex due to numerous intervening variables in the decision making process, such as differing institutional structures and political culture. These variables can also influence each other, making it extremely difficult to assess the outcome of the interaction between the two 'worlds'. With respect to the U.K., the worlds of the research community and policy makers are closely intertwined, but the actual interaction between them, in particular in the defence domain, remains difficult to assess. In the U.S., these worlds are much more disconnected from each other and more visible to the public. However, the actual processes remains vague and complex as well, and, therefore, make it difficult to provide a clear

explanation for different outcomes between what is regarded as important in the research community and in the actual policy.

In the second part of the study, the text mining analysis of the data was crucial. On the basis of the defined foresight dataset for each country and the text mining results, the coherence with the respective defence policies of the U.S. and U.K. has been assessed. The results are the following:

- The text mined results of the policy documents show a considerable overlap with the priority security areas stated explicitly in the Defence White Papers of both the U.S. and the U.K.;
- The security and defence foresight discourse focusing on the U.S. is predominantly concerned with 'hard' topics, i.e. compared to the U.K. it shows considerable higher scores for terms such as *military*, *weapon*, *terror*, *army*, *warfare*, *missile,* etc.;
- With regard to the U.S. dataset, the security themes that came out of the text mining analysis show a large overlap with the themes mentioned in the 2006 QDR;
- The themes 'Changing Power Structures' and 'Energy Security' were regarded as very important within the foresight discourse of the U.S. dataset, but did not show up in one of the priority areas of the 2006 QDR;
- The security and defence foresight discourse focusing on the U.K. is mostly concerned with 'soft' issues, i.e. compared to the U.S. it shows considerable higher scores for terms as *environment*, *energy, emission*, *health*, *dioxide*, *agriculture*, etc.;
- With regard to the U.K. dataset, the security themes that came out of the text mining analysis show a considerable coherence overlap with the themes and strategic trends mentioned in the 2004 Defence White Paper;
- Although regarded as very important future issues for the U.K. defence environment, themes as 'Nature & Environment' and 'Energy Security' are only partly touched in the long list of strategic trends;
- The text analysis of the foresight discourse did not identify some of the issues stated as strategic trends as particularly important, i.e. dealing with North Atlantic/European security architecture, the clash between Western and Islamic cultures, humanitarian intervention in Africa and space and cyberspace as new conflict areas. However, some of these do show up in relation to some of the other themes or sub themes.

To conclude, the main research question cannot be answered decisively. Based on the chosen methodology to conduct a meta-analysis using text mining and data analysis software, the

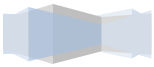
impression is that the foresight discourse in the field of security and defence does reflect the priority areas as identified in the 2006 QDR and 2004 Defence White Paper. Most areas are well covered in the text analysis, suggesting a proper incorporation of studies originating from the research community operating in this field into the strategic defence policy process of their governments. This is in conjunction with the theoretical framework, which resulted in the normative content that the use of foresight analysis should be reflected in the formulation of the defence policy of the U.K. and the U.S. However, to go one step further and identify an actual 'hard' correlation between the two is problematic. Neither it is possible to make a proper assessment whether it works the other way around, i.e. that defence policy 'drives' the foresight discourse. At this point it is also hard to determine to what extent academic schools of thought about defence planning is incorporated in the choice for particular foresight topics and the actual defence policy. Although the chosen methodology did not take these issues into account, it is well worth considering it for future research.

Therefore, more research is needed on the extent to which these foresight studies cover the actual 'foresight universe' in this domain and how the nature and direction of the chosen topics are driven. Also, more research should be done on the research – policy nexus to examine the actual intrusion of foresight analysis into defence policy making. These arguments will be further elaborated in sections 6.2 and 6.3.

6.2 Discussion

So far there have been very few systematic attempts to validate and examine the added value of efforts to include foresight analysis in the strategic planning process. The 'meta-foresight' approach taken in this study was grounded on the premise that foresight analysis should be taken more seriously and be taken to a higher level in the policy process. A crucial part of this has been the reliance on the dataset of so-called future-oriented ('foresight') studies. Such a database helps us in two ways:

- Offering 'honest' foresight analyses, based on a meta-analysis of future explorations in multiple domains (energy, environment, technology, social issues, security, etc.). This provides a systematic insight into the existing range of opinions on different topics before being interpreted by the researcher;
- Enable us to evaluate foresight exercises on reliability and added value in general (what has become reality, what did not?); are some domains more reliable than other in the ocean of



foresight material?; does it really lead to indiscernible strategic choices in the planning process?

The current research and analysis of the scenario space of future issues in the field of security and defence is based on a comprehensible, but often limited dataset and resources. Most effort is put in developing models that focus on small, but crucial, elements of the battle space, while less analytical attention is paid to underlying issues in the broader political, military, economic, social and informational realm. Modelling these underlying, complex systems requires large amounts of data as inputs. Not only collecting, but also analysing these datasets are technological challenges for which the defence and security community has come to realise requires an enhanced and innovated analytical toolbox. Text mining software is a tool that has become increasingly important for exploratory analysis of large bodies of literature. Therefore, in this study a rather innovative approach was taken to use text mining to support the identification and analysis of emerging and changing concepts within the security and defence foresight discourse.

As mentioned, the correlation between the foresight discourse and the actual integration of its major themes with the final defence policy remains difficult to assess for two main reasons:

1. Information database: The actual reflection of the foresight discourse in the respective defence policies of the U.K. and U.S. depends to a large degree on the foresight database itself. As was stated in the main research question, the purpose was to use publicly available foresight studies – since internal and rubricated studies are obviously not accessible for this study. Although the security and defence foresight database (mainly focused on the U.K. and the U.S.) used in this study is quite exhaustive compared to other databases, the question still remains whether it provides a well-grounded reflection of the actual foresight population in this field.

In line with this is the source base used for the purposes of this study. The bulk of foresight studies originate from recognised think tanks, research institutes and agencies within governments themselves. Although this does not necessarily indicate ‘quality’, it does give some validity and legitimacy to the content of the studies. Yet it is unknown whether this is a reasonable reflection of the total foresight population in the field of security and defence. In the domain of social network analysis, trend analysis and spotting ‘weak signals’, information sources such as blogs and chat forums could also be of major value.

As mentioned before, the current methodology did not take into account what the motivations are of the organisations to undertake foresight analysis in particular fields. For example, it is possible that researchers are driven by expert interests, financial motives, their assignors (government or business) or the media. The same accounts for the influence of existing, 'mainstream' defence planning literature on both the foresight discourse as well as on the formulation of defence policy itself. Therefore, it is well worth investigating what the 'drivers' are of the topics chosen for the foresight studies and to what degree it is possible to examine the role of schools of thought in the nature and direction of both foresight studies and defence policy.

2. Research – policy nexus: The goal of generating foresight analyses is to better understand the mix of strategic decisions to be made in the face of a multitude of challenges and uncertainties posed by the external environment. However, the extent to which foresight actually leads to indiscernible strategic choices for defence planning is difficult to assess. Not only is the meta-analysis of the foresight studies of importance, but also the critical aspect of the usage of the foresight methodology lies in the need to have an impact on policy decisions.

The value of the text mining results was in part dependent on the extent that they could feed back into the theoretical framework of the research – policy nexus. This way a better assessment could have been made to what extent 'foresight analysis' is actually used in the policy making process. However, the interaction process between research community and policy makers is difficult to assess due to a myriad of factors (e.g. cultural, communication, political sensitivity of the topic, researcher motivations, stage in the policy process and financial arrangements) that can affect the link between both worlds.

To give a clear overview of these parameters and variables, the following table is provided:

Parameter	Explanatory variable	Effect	Probability
Foresight database	Majority of foresight studies in this field are also publicly available	Good reflection of foresight database compared to actual foresight population	Medium – High
	Threshold of terms 'security' and 'defence' eliminates noise and improves relevance of selected	Good reflection of foresight studies compared to actual foresight population	High

	studies		
	Most foresight studies in this field are rubricated / only for internal use	Little reflection of foresight studies compared to actual foresight population	Low – Medium
	Other sources besides the renowned organisations must be involved as well, i.e. blogs and forums	Little reflection of foresight studies compared to actual foresight population	Medium
Research – policy nexus	Meta-analysis match actual content / priority areas described in defence policy	Good interaction research community – policy making	Low – Medium
	Meta-analysis match actual content / priority areas described in defence policy	Interaction level research community – policy making in this field unclear and needs further research	High

Table 6.1: Discussion overview

The last column tries to give a basic indication of the probability that these effects occurred in this study and do not necessarily indicate what kind of consequences this should have for the results.

6.3 Recommendations for future research

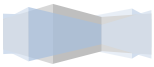
The major building blocks in this study have been the meta-analysis approach by using text mining and data analysis software, the degree of 'foresight-ness' in the defence policy of the U.K. and U.S. and the discussion of 'evidence-based policy'. For each of these areas there are several elements that need to be further researched:

- The field of text mining is relatively young, but fast growing and offers huge potential to analyse large amounts of data. More research should be done in the development of the possibilities of features in these tools that could result in better results, e.g. multilingual text handling capability, semantic tagging, natural language processing techniques, categorisation and clustering of concepts, sentiment analysis, crawling of important topics on the internet, etc. All these functionalities could improve the quantitative text analysis of huge datasets,

which is getting an increasingly important tool in the toolbox of strategic defence planners and intelligence services. Recently, the importance of this methodology has been acknowledged by the Dutch MoD, that initiated together with TNO Defence & Security and the Indian Institute for Technology a large scale benchmarking exercise of text mining tools, thereby making an inventory of what could be of use for their own data analysis purposes;

- Yet it remains unclear what the actual motivations are of researchers and policy makers to choose particular topics and directions for their (foresight) analysis, e.g. this can be driven by politics, financial motivations, societal factors, media, etc. Moreover, the direction foresight – policy is also not linear and might well be the other way around as well. Future research is definitely needed to get more insight on these issues. The same also accounts for the role of more formal, established defence planning literature in the nature and direction of both foresight studies and defence policy.
- Although there is a general consensus in the literature that foresights originated in the military realm – albeit under different a terminology – and made its entry into the business environment and policy making world, the question of how much real use of foresight analysis exists in today's defence policy formulation and implementation remains unanswered. There are signs that policy makers draw on a wide variety of 'foresight sources', but at what level and to what degree is unclear and needs further study;
- In the same vein, the basic interaction process between the research community and policy world in the defence domain is not well researched yet. There is still a long road ahead in the theoretical reflection of this nexus, and there seems to be a need for greater investment in empirical research of this issue. This should bring to bear elements of the actual reality that help decipher the acknowledged complexity in the issue of the use of scientific knowledge in the policy process. To assess more systematically what knowledge is most valuable when, where and how, case studies are a possibility to illustrate the various ways in which scientific research can connect to policy.

These recommendations are aimed to improve the establishment of good strategic foresight processes in policy making, in particular in the defence domain. Not only learning from the various foresight programs in the public and private sector can support this, but also how 'the art of the long view' can be brought into the policy process. This should lead to more flexible, adaptive and robust strategic defence planning, which is imperative in today's fast changing, highly uncertain security environment.



6.4 Reflection on research process

My current activities at The Hague Centre for Strategic Studies focus on foresight analysis, identifying and evaluating policy options, and developing strategies pertaining to issues of national and international security. For the "Project National Security", our approach was to conduct a so-called meta-analysis of an extensive pool of foresight studies covering a broad range of dimensions. For this purpose, an innovative technique called text mining was used to filter out the most important themes in the foresight discourse and assess whether they touched upon the security domain and vital interest of Dutch national security. During this process, the question raised whether this approach could also be applied to analyse the use of foresight analysis in defence policy making in other countries, i.e. the United Kingdom and United States. In studying the relevant literature, it appeared that little research has been undertaken in this field so far. It seemed that foresight analysis *an sich* was an acknowledged method to make strategic defence planning more flexible, adaptive and robust, but the way the security and defence foresight discourse was reflected in the actual defence policy remained unclear.

In first instance, the purpose was to text mine all policy documents that described the processes and sources feeding into the formulation of the actual defence policies. The ideal outcome was to get an actual insight in the way different actors deliver such input, what methodologies they used and which security themes would be dominant. However, during the research, it appeared that the bulk of this information was not publicly accessible. Therefore, I could only study the end result of this complicated process, the actual defence policy, respectively the 2006 QDR (U.S.) and the 2004 Defence White Paper (U.K.). Whereas the use of text mining is convenient in analysing very large datasets, I nevertheless text mined the relevant defence policy documents as well. This was important for consistency reasons, since the foresight studies themselves were also text mined.

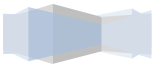
The largest pitfall, but also the most exciting and interesting exercise in the entire process, was of course the text mining procedure. Since it is a rather new and refreshing approach to analyse data in an unbiased, apolitical and efficient manner, it still was uncertain how the output would look. Although the method itself proved to be quite successful, text mining alone did not suffice. In order to cope with the long lists of important terms as identified by the text mining software, a data analysis program and several visualization methods were used. This way a better view of the results could be generated and support the process of prioritising of the security themes.

One of the elements that needed some clarification during the research process was the difference between the *foresight methodology* and *foresight studies*. The former represents the processes of

interactions among science, technology and society with regard to future intelligence gathering in the field of security and defence, and how this can be used in present-day policy making. The latter encompasses all future oriented studies (or exercises) as being stand alone efforts and could in itself be the products of some foresight methodology used for other purposes than defence policy making. The use of these studies for further analysis and the link specifically to the security and defence domain is what makes it the 'foresight methodology'. It was important to point out that although the collected studies were regarded as 'foresight studies', they did not necessarily had to be labeled as being 'foresight'. For example, some of the studies were purely forecasts. The most important element is that they are 'future-oriented' and that the triangulation of all these different studies (classified as 'foresights', 'foresight studies' or 'foresight exercises') is the basis is of the 'foresight methodology'.

The collected foresight exercises originate from research world establishments such as think tanks, research institutes, government agencies or commercial studies. By analysing which themes within these studies are dominant and in what way this is reflected in the defence policy, I attempted to find out the degree of 'evidence-based' policy. This way, better insight could be generated to see why some actors / researchers do penetrate the policy formulation process, while others do not. The first intention of this study was to examine how foresight actually trickles down in the policy making process. The goal was to link the theoretical framework – stating that in defence planning there is a rise in the use of foresight analysis – with the security and defence foresight discourse and the actual defence policy. To do this most honestly, text mining software was used. This did not necessarily say anything about the 'level of intrusion' of foresight into the policy process. This had the consequence to change the focus of the study to a step prior to this, namely to see in what way the foresight discourse is reflected in the defence policy rather than determine its 'trickle down effect'.

Overall, the process has been very exciting and quite satisfactory. Although the results are not that ground breaking, the method used to come up with the results is very promising to apply in other policy domains as well. I want to acknowledge the support from my supervisor at the Erasmus University prof. dr. Ko Colijn and my co-reader dr. Vincent Homburg for their essential control function they offered and valuable support and comments given in writing this Master thesis. A lot of freedom of movement was given, so the subject choice, methodology and realisation of the research was not restricted in any way. Also, the help of Stephan De Spiegeleire, Director Defence Transformation at HCSS and Erik Frinking, Director National Security and Intelligence was invaluable



in this effort. Lastly, after the writing of the initial research proposal, the remaining stages in the process were a matter of following the set planning and structure. In doing the research I encountered many learning moments, difficult periods, but also, a lot of satisfaction in the end.

Appendix A: List of foresight studies

Title	Used for	Year	Executor
11 September and China; Opportunities, Challenges and Warfighting	US / UK	2002	Institute of Defence and Strategic Studies (IDSS)
2003 State of the Future	US / UK	2003	Millennium project reports
2003 Ten Year Forecast	US / UK	2003	Institute for the Future
2004 state of the future	US / UK	2004	American Council for the United Nations University
2004 Ten Year Forecast	US / UK	2004	Institute for the Future
2005 State of the Future	US / UK	2005	American Council for the United Nations University
2005 Ten Year Forecast	US / UK	2005	Institute for the Future
2025 Aerospace Replenishment; The Insidious Force Multiplier	US	1996	Air University Center for Strategy and Technology
2025 operational analysis	US	1996	Air University Center for Strategy and Technology
21st Century Defense technology strategy	US	1999	Defence Science Board
A Better World in 2020; Wake up calls for the next generation	US / UK	2001	International Food Policy Research Institute
A Chemical and Biological Warfare Threat -- USAF Water Systems at Risk	US	1999	USAF Counterproliferation Center / US War College
A Contrarian View of Strategic Aerospace Warfare	US	1996	Air University Center for Strategy and Technology
A Hundred Osama's; Islamist Threats and the Future of Counterinsurgency	US	2005	Strategic Studies Institute of the US Army War College (SSI)
A hypersonic attack platform	US	1996	Air University Center for Strategy and Technology
A Military for the 21st Century; Lessons from the Recent Past	US / UK	2001	Institute for National Strategic Studies (INSS)
A Virtuous Warrior in a Savage World	US / UK	1999	Charles J. Dunlap Jr.
Abrupt Climate Change and its implications for the United States National Security	US	2003	Schwartz & Randall (Academia)
Advanced modeling and simulation for analysing combat concepts in the 21st century	US / UK	1999	Defence Science Board
Aerial Targets	US	2005	Defence Science Board
Aerospace Sanctuary in 2025	US	1996	Air University Center for Strategy and Technology
Afghanistan and the Future of Warfare	US / UK	2002	Strategic Studies Institute of the US Army War College (SSI)
All possible wars; toward a consensus view of the future security environment	US	2001	Institute for National Strategic Studies (INSS)
Alternative Futures for 2025; Security Planning to Avoid Surprise	US	1996	Department of Defense School
Alternative Futures in War and Conflict	US	2000	Center for Naval Warfare Studies
Alternative Futures of War; imagining the impossible	US / UK	2004	Metafuture
Alternative World Scenarios for a new Order of Nations	US / UK	1993	US Army War College

American Way of War Through 2020	US	2004	The CNA Corporation
Army Transformation Roadmap	US	2002	Defense Technical Information Center
As Asia's Population Ages, Worries Grow about the Future	US / UK	2002	East-West Center (EWC)
Asian Oil Market Outlook; Role of the Key Players	US / UK	2003	East-West Center (EWC)
Asian Reponses to the United States	US / UK	2003	National Intelligence Council
Assessing Future Risks of Flooding and Coastal Erosion; Synthesis of Results -	US / UK	2003	UK Foresight Programme
Assessment of the Emerging Biocruise Threat	US	2000	USAF Counterproliferation Center / US War College
Assuring Food and Nutrition Security in Africa 2020	US / UK	2004	International Food Policy Research Institute IFPRI
Asymmetric Conflict 2010	US	2000	Institute for Defense Analysis
Asymmetrical Rivals; the Enemy Next Time	US	2005	Barry Schneider
Biocruise -- A Contemporary Threat	US	2000	USAF Counterproliferation Center / US War College
Bridging the gap	US	2005	Defense Advanced Research Projects Agency
Capstone Concept for Joint Operations	US	2005	US Department of Defense
Caucasus and Central Asia, Towards a Non-Strategy	US / UK	2002	East-West Center (EWC)
Central Asia, State Building in the Face of Insurgent Islam	US / UK	2004	East-West Center (EWC)
Central Asia’s Strategic Revolution	US / UK	2003	East-West Center (EWC)
Chemical-Biological Attack -- Achilles Heel of the Air Expeditionary Force	US	1999	USAF Counterproliferation Center / US War College
China and Nonproliferation, The Changing Context	US / UK	2001	East-West Center (EWC)
China and the Geopolitics of Oil in the Asian Pacific Region	US / UK	2005	East-West Center (EWC)
CHINA DEBATES the FUTURE SECURITY ENVIRONMENT	US / UK	2000	Institute for National Strategic Studies (INSS)
China Insistence on No-First-Use of Nuclear Weapons	US / UK	2005	East-West Center (EWC)
China, Kazakh Energy, and Russia, An Unlikely Ménage à Trois	US / UK	2005	Central Asia-Caucasus Institute and Silk Road Studies Program
China's Space Program, Emerging Competitor or Potential Partner	US / UK	2003	Center for Nonproliferation Studies (CNS)
Chinese armed forces in the 21st century	US / UK	1999	Strategic Studies Institute of the US Army War College (SSI)
Chinese Nuclear Policy and the Future of Minimum Deterrence	US / UK	2005	Center for Contemporary Conflict (CCC)
Chinese Views of Future Warfare	US / UK	2001	Institute for National Strategic Studies (INSS)
Clausewitzian Friction and Future War	US / UK	2004	Institute for National Strategic Studies (INSS)
Climate Change Scenarios for the UK	UK	2002	University of East Anglia
Climate OptiOns for the Long term (COOL)	US / UK	2002	Earthscan
Close Air Support (CAS) in 2025	US	1996	Air University Center for Strategy and Technology
Coastal Defence Vulnerability 2075	UK	2002	Proudman Oceanographic Laboratory
Controlling Weapons of Mass Destruction	US / UK	2001	United States Institute of Peace

Conventional Operations and Warfare	US	1999	Institute for National Strategic Studies (INSS)
Conversion at Stepnogorsk, What the Future Holds for Former Bioweapons Facilities	US / UK	2003	Peace Studies Program
Crime prevention Panel; Just around the Corner	UK	2000	UK Foresight Programme
Current and Future Challenges for Asian Nonproliferation Export Controls, A Regional Response	US / UK	2005	Strategic Studies Institute of the US Army War College (SSI)
Cyber Trust and Crime Prevention project - Gaining insight from three different futures	UK	2004	UK Foresight Programme
Cyber Trust and Crime Prevention; Risk management in Cyberspace	UK	2004	UK Foresight Programme
Debris and Future Space Activities	US / UK	2002	Center for Nonproliferation Studies (CNS)
DEEP ATTACK WEAPONS MIX STUDY	US	1997	Defence Science Board
Defence policy; future trends to 2050	UK	2004	High Level Assumptions Group
Defence Science and Technology Base for the 21st Century	US	1998	Defence Science Board
Democracy, International Governance, and the Future World Order	US / UK	2005	Globus Publishing House
DoD Homeland Defense & Civil Support JOC	US	2005	US Department of Defense
Does the US Face A Future of Never-ending Subnational	US	2004	National Intelligence Council
Easternisation; Asian power and its impact on the West	US / UK	1995	Demos
Economic Evolution in China and its Impact on Trilateral Interrelations among China, Japan and the United States	US / UK	2003	Pacific Forum CSIS
Emerging Missile Challenges and Improving Active Defenses	US	2004	USAF Counterproliferation Center / US War College
Emerging Risks in the 21st Century OECD International Futures Project	US / UK	2003	OECD
Energy and Environment 2040	US / UK	2004	Copenhagen Institute for Future Studies
Energy for tomorrow	UK	2001	UK Government
Energy Futures	US / UK	2000	UK Government
Energy Futures Task Force; Fuelling the Future	UK	2000	Foresight Energy and Natural Environment Panel
Energy needs, choices and possibilities - scenarios to 2050	US / UK	2001	Shell
Energy Revolution	US / UK	2005	Greenpeace
Energy Scenarios	US / UK	2001	Nebojsa Nakicenovic
Energy scenarios to 2020	UK	2003	UK Foresight Programme
Energy to 2050 - Scenarios for a sustainable future	US / UK	2003	International Energy Agency &OECD
Energy; The Next Fifty Years	US / UK	1999	OECD
Environmental Impact of the Use of Natural Resources	US / UK	2004	IPTS

Evolution of Conflict Through 2020; Demand on Personnel	US / UK	2004	National Intelligence Council
Fighting on the Edges; the nature of war in 2020	US	2004	Maj-Gen. Robert Scales (ret.)
Flood and coastal defence	UK	2004	UK Government
Force Management JOC	US	2005	US Department of Defense
Force Structure for High- and Low-Intensity Warfare	US	2004	National Intelligence Council
Foresight - Health Care 2020	UK	2000	Health Care Panel
Foresight - Trends and Drivers in Intelligent Infrastructure Systems	UK	2004	UK Foresight Programme
Foresight Futures 2020	US / UK	2002	Department of Trade and Industry, UK
Frontier Missions; Peacespace Dominance	US	1996	Air University Center for Strategy and Technology
Future Challenges from the Sea	US / UK	2004	Institute of Defence and Strategic Studies (IDSS)
Future Challenges to European Security from a Specific Military Perspective	US / UK	2001	Admiral Sir Peter Abbott, GBE, KCB
Future Flooding; Executive Summary	UK	2004	UK Government
Future international environmental security issues and potential military requirements	US / UK	2001	Army Environmental Policy Institute
Future Navy - operational concept	UK	2001	UK Ministry of Defence
Future of Force	US	2003	National Intelligence Council
Future Outlook For World Food Production	US / UK	1996	Economic Research Service, U.S. Dept. of Agriculture
Future Posture	US	1998	Institute for National Strategic Studies (INSS)
Future scenarios in International public health 2006-2015	US / UK	2005	Pan American Health Organization & World Health Organization
Future Security Environment in 2025	US / UK	2004	Canadian DoD
Future security in space; commercial, military, and arms control trade-offs	US	2005	Mountbatten Centre for International Studies / Center for nonproliferation studies
Future Strategic Strike Forces	US	2004	Defence Science Board
Future War-Future Battlespace; The Strategic Role of American Landpower	US	2003	Strategic Studies Institute of the US Army War College (SSI)
GAM, Islam and the Future of Aceh	US / UK	2005	Institute of Defence and Strategic Studies (IDSS)
Geopolitical Developments and the Future of the Space Sector	US / UK	2004	OECD
Geopolitics, the next wave	US / UK	2004	The Challenge Network
Global Evolutions & Role of Nuclear Weapons	US / UK	2004	Center for Naval Analyses
Global HIV AIDS Crisis	US / UK	2000	World Economic Forum
Global Strike JIC	US	2005	US Department of Defense
Global Trends 2015 A Dialogue About the Future With Nongovernment Experts	US / UK	2000	National Intelligence Council
Global Trends 2030	US / UK	2005	Freeworldacademy

Global Water outlook to 2025	US / UK	2002	International Food Policy Research Institute
Globalization & Security	US / UK	1999	Defence Science Board
Globalization and the Nature of War	US / UK	2003	Strategic Studies Institute of the US Army War College (SSI)
Health and Safety Executive; Horizon Scanning	UK	2004	UK Government
Healthy futures for APEC megacities	US / UK	2000	APEC center for technology foresight
High Energy Laser Weapon Systems Applications	US	2001	Defence Science Board
Hit'em Where It Hurts; Strategic Attack in 2025	US	1996	Air University Center for Strategy and Technology
How We Want to Live Tomorrow - Reports on the future - Asia's Future in a Internationalized World	US / UK	1999	Centrum Fur angewandte politikforschung
Impact of geopolitical and security environment in 2020 on Southeast Asian armies Forging cooperative security	US / UK	2003	Ministry of Defense, Australia
Infectious Diseases in Africa; using science to fight the evolving threat	US / UK	2005	Office of Science and Technology
Information Attack; Information Warfare In 2025	US	1996	Air University Center for Strategy and Technology
Information Operations; A New War-Fighting Capability	US	1996	Air University Center for Strategy and Technology
Information Operations; Wisdom Warfare For 2025	US	1996	Air University Center for Strategy and Technology
Insurgency and counterinsurgency in the 21st century	US / UK	2004	Strategic Studies Institute of the US Army War College (SSI)
IPCC Special Report; Emissions Scenarios	US / UK	2000	IPCC
Islamic Civilization in Globalization	US / UK	2003	Metafuture
Japan-US Security Relations, Managing Future Challenges	US / UK	2003	Pacific Forum CSIS
Joining Forces; From national security to networked security	US	2005	Demos
Joint Operations Superiority in the 21st Century	US	1998	Defence Science Board
Joint Vision 2020	US	2000	Department of the Navy, Department of the Air-force, Department of the Army, Coastguard, USA
Long-Term Global Demographic Trends; Reshaping the Geopolitical Landscape	US / UK	2001	RAND
Long-Term Prospects for Africa's Agricultural Development and Food Security	US / UK	2005	International Food Policy Research Institute
Mapping the Global Future - NIC 2020	US / UK	2004	National Intelligence Council
Millennium Project 2020 Global Energy	US / UK	2005	American Council for the United Nations University
Nanoscience and nanotechnologies - opportunities and uncertainties	UK	2004	The Royal Society
Nanotechnology the technology for the 21st century	US / UK	2002	APEC center for technology foresight
NATO Future Worlds	US / UK	2005	Clingendael Centre for Strategic Studies
Natural Resources and The Environment Panel Report	US / UK	1999	IPTS
Naval strategic plan	UK	2004	UK Ministry of Defence

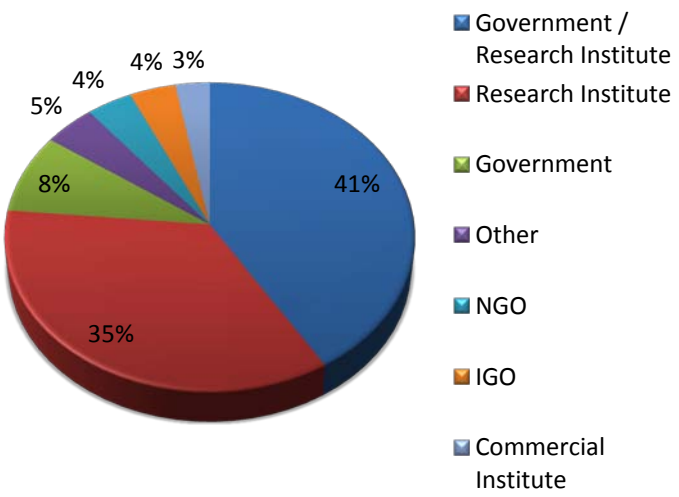
New Risks and Opportunities for Food Security - Scenario Analyses for 2015 and 2050	US / UK	2005	International Food Policy Research Institute
New Threats and the Use of Force	US / UK	2003	Danish Institute for International Studies
New World Vistas Air and Space Power for the 21st Century	US	1995	Air University Center for Strategy and Technology
NEW WORLD VISTAS; Looking toward the Future, Learning from the Past	US	1999	Air University Center for Strategy and Technology
Next Generation Bioweapons; the Technology of Genetic Engineering Applied to Biowarfare and Bioterrorism	US	2002	USAF Counterproliferation Center / US War College
NIC - Europe 2020	UK	2004	National Intelligence Council
OECD Environmental Outlook	US / UK	2001	OECD
Or Go Down In Flame - An Airpower Manifesto for the 21st Century	US	1996	Air University Center for Strategy and Technology
Osama's Wake; the Second Generation of al Qaeda	US	2005	USAF Counterproliferation Center / US War College
Out of the Box And Into the Future	US	2000	US Potomac Institute
Overview of the Future Security Environment	US / UK	2003	RAND
Paths to Extinction; The US Air Force in 2025	US	1996	Air University Center for Strategy and Technology
Pathways to Energy & Climate Change 2050	US / UK	2005	World Busines Council for Sustainable Development
People Flow; Managing migration in a New European Commonwealth	US / UK	2003	Demos
PEOPLE'S LIBERATION ARMY AFTER NEXT	US / UK	2000	Strategic Studies Institute of the US Army War College (SSI)
Planetary Defense: Catastrophic Health Insurance for Planet Earth	US / UK	1996	Air University Center for Strategy and Technology
Plant-Crop-based Renewable Resources 2020 - A vision to enhance U.S. Economic Security through renewable plant-crop-based resource use	US / UK	1998	Various Private Companies
Possibilities of War: The Confluence of Persistent Contemporary Flashpoints and Worrisome New Trouble Spots	US	2004	National Intelligence Council
Post 9-11 Scenarios. The Future of Global Security	US / UK	2002	Institute for Nuclear Materials Management
Power without pollution	UK	2002	UK Government
PREPARING FOR PLANETARY DEFENSE; Detection and Interception of Asteroids on Collision Course with Earth	US / UK	1994	Air University Center for Strategy and Technology
Preparing for the 21st century - Executive Summary	US	1996	Commission on the Roles and Capabilities of the U.S. Intelligence Community
Preventing Armageddon II; Confronting the Specter of Agriterror	US	2004	Center for Contemporary Conflict (CCC)
Reshaping America's Military	US	2002	Council on Foreign Relations
Reshaping the Expeditionary Army to Win Decisively	US	2005	Strategic Studies Institute of the US Army War College (SSI)
Rethinking asymmetric threats	US / UK	2003	Strategic Studies Institute of the US Army War College (SSI)
Rivers at Risk - Dams and the future of freshwater ecosystems	US / UK	2004	WWF

Roundtable Report; Assessing the Military Threats of the Future	US / UK	2004	New Defence Agenda
SARS; Down But Still a Threat	US / UK	2003	National Intelligence Council
Saudi Arabia; Islamic Threat, Political Reform, and the Global War on Terrorism	US / UK	2005	Strategic Studies Institute of the US Army War College (SSI)
Security and Power in 2020	US / UK	1999	The Challenge Network
Shell_global_scenarios_1998_2020	US / UK	1998	Shell
Smallpox; A Primer	US	2000	USAF Counterproliferation Center / US War College
Social Identity and the Roots of Future Conflict	US	2003	National Intelligence Council
Sources of Conflict in the 21st Century	US / UK	1998	RAND
Space Operations; Through The Looking Glass	US	1996	Air University Center for Strategy and Technology
Special Forces and the Future of Warfare	US	2004	National Intelligence Council
Strategic Communication	US	2004	Defence Science Board
Strategic Horizons; military implications of alternative futures	US	1997	Strategic Studies Institute of the US Army War College (SSI)
Surfing the First and Second Waves in 2025	US	1996	Air University Center for Strategy and Technology
The Age of Revolutions	US	1998	Strategic Studies Institute of the US Army War College (SSI)
The Chinese People's Liberation Army In 2020	US	2004	National Intelligence Council
The Defence Industry in the 21st Century	US / UK	2005	PriceWaterhouseCoopers
The Economic Impact of a Bioterrorist Attack: Are Prevention and Postattack Intervention Programs Justifiable?	US / UK	1997	Centers for Disease Control and Prevention
The Future and How To Think About It	UK	2003	UK government
The Future of Conflict; Looking out to 2020	US / UK	2003	Conflict Studies Research Centre
The Future of NATO	US / UK	2003	Center for International Relations
The Future of netcrime now; Part 1 - threats and challenges	US / UK	2004	Home Office Crime and Policing Groups
The future of the global environment	US / UK	1997	UNEP, RIVM, the Netherlands
The Future of the Internet	US / UK	2005	PEW INTERNET & AMERICAN LIFE PROJECT
The Future of Transcaspian Security	US / UK	2002	Strategic Studies Institute of the US Army War College (SSI)
The future security environment in the middle east	US / UK	2004	RAND
The Global course of the information revolution political, economic, and social consequences	US / UK	2000	Rand Corporation
The Global Infectious Disease Threat and Its Implications for the United States	US	2000	National Intelligence Council
The Impact of Demographic Change	UK	2000	UK Government
The Long War of the 21st Century	US	2002	Foundation for the Defense of Democracies
The Military Role in Countering Terrorist Use of Weapons of Mass Destruction	US	1999	USAF Counterproliferation Center / US War College

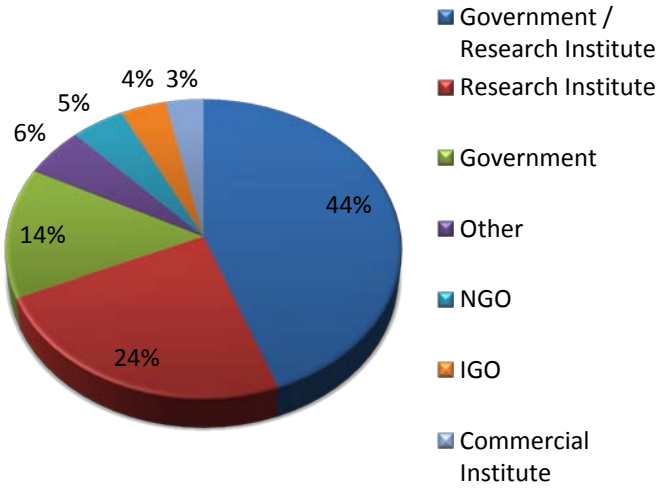
The new space race; challenges for US national security and free enterprise	US	1999	Heritage Foundation
The Physical World in a Virtual Age	UK	2000	UK Government
The revenge of the Melians; Asymmetric threats and the next QDR	US	2000	Institute for National Strategic Studies (INSS)
The Security Implications of Microdisarmament	US	2000	USAF Counterproliferation Center / US War College
The US Anti-Missile Defence Concept and the Future of Strategic Arms Control	US	2002	Center for Security Studies
The World after Iraq	US / UK	2005	The Challenge Network
The World in 2050	US / UK	2000	Nick Bostrom
THE WORLD OF 2020 AND ALTERNATIVE FUTURES	US / UK	1994	Air University Center for Strategy and Technology
The Worlds Water; is there enough	US / UK	1997	World Meteorological Organization
Thinking about China and War	US / UK	2001	Jeffrey Record
Three Scenarios for the Middle east	US / UK	2004	American Council for the United Nations University
Training For Future Conflicts	US	2003	Defence Science Board
Transforming Transformation; Will it Change the Character of War?	US	2004	National Intelligence Council
Trash or Treasure - Knowledge Warfare and the Shape of Future War	US / UK	2003	Strategic & Defense Studies Center
U.S. Commission on National Security21st Century	US	2001	Hart-Rudman Commission
UAVs-UCAVs - Missions, Challenges, and Strategic Implications for Small and Medium Powers	US / UK	2004	Institute of Defence and Strategic Studies (IDSS)
UK National Foresight Energy Security	UK	2004	Technology Foresight Panel on Energy
US Space Command Vision for 2020	US	1997	US Space Command
Waiting for Terror; How Realistic Is the Biological, Chemical and Nuclear Threat	UK	2001	Oxford Research Group
Water 2025 Preventing Crises and Conflict in the West	US / UK	2003	Department of Interior
Water and Food to 2025	US / UK	2002	International Food Policy Research Institute IFPRI
Water supply and management in the APEC region	US / UK	1999	APEC center for technology foresight
Water and Conflict	US / UK	2004	Danish Institute for International Studies
What Scenario Studies tell about Security of Energy Supply in Europe	US / UK	2001	Energy Research Centre of the Netherlands
Which Army After Next - the Strategic Implications of Alternative Futures	US	1997	US Army War College
World Food Prospects; Critical Issues for the Early Twenty-first Century	US / UK	1999	International Food Policy Research Institute
World Population to 2300	US / UK	2004	United Nations
World Water and Food to 2025	US / UK	2002	International Food Policy Research Institute

Appendix B: Cross-sections U.S. and U.K. datasets

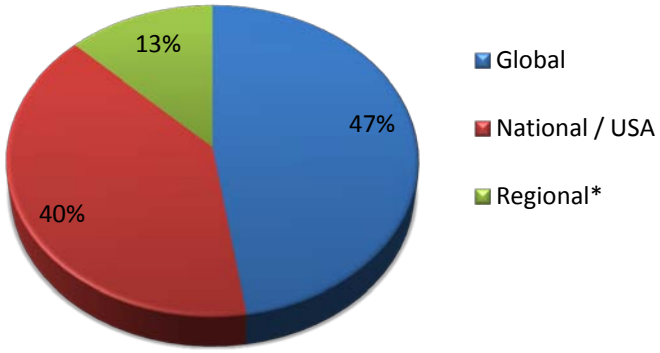
Type of source - U.S. dataset



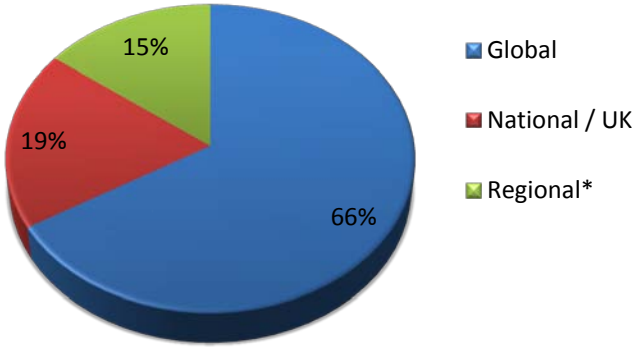
Type of source - U.K. dataset



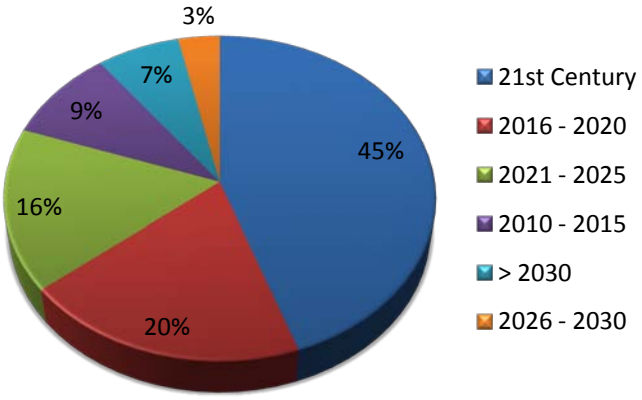
Focus - U.S. dataset



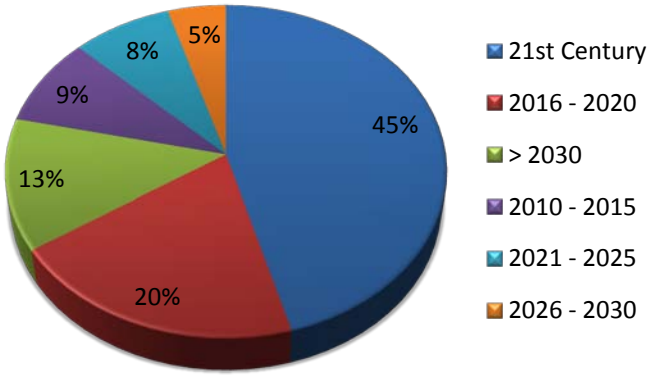
Focus - U.K. dataset



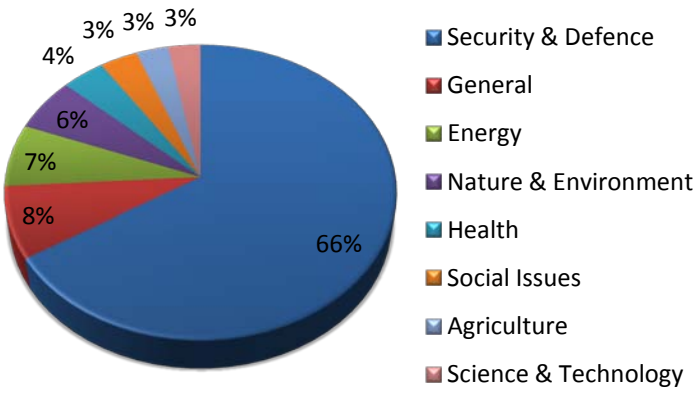
Time horizon - U.S. dataset



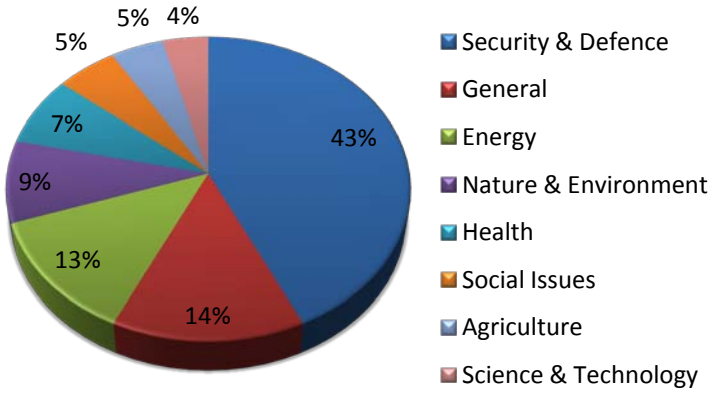
Time horizon - U.K. dataset



Category - U.S. dataset



Category - U.K. dataset



Appendix C: The scoring process in Text Analyst

In calculating the semantic weight of a term, two main stages can be identified: **pre-processing** and **processing**.

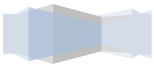
Step 1 - Pre-processing: *preparation of text for calculation of semantic weights*

In this stage, Text Analyst deletes numbers, URLs, punctuation and abbreviations that include dots (for example *i.e.*, *e.g.*, *U.S.A.* and *R.A.F.*). With regard to the latter, abbreviations without dots are included (for example TA does calculate the semantic weight of *USA* or *RAF*). Another part of the pre-processing stage is called *stemming*. Here, Text Analyst recognizes single and plural forms as one term. A morphological analysis takes place, so that for example "*nationalities*" is changed into "*nationality*". This means that the last letters of a term are replaced by the suffix of the term from which it is derived. However, it is important to note that there are more exceptions than rules in a language, so when it comes to different words that fall beyond the usual stemming process, like "communist" and "communism" they are recognized as such and the suffix remains intact. This is the case when the term being analysed, is not recognized by one of the dictionaries used by Text Analyst (see below for a further explanation of the dictionaries).

In the pre-processing stage, the text is divided in fragments (sentences, sections or entire text). With regard to *sentences*, this means that a term is weighted with respect to the other terms in the same sentence in which it is mentioned. With regard to *sections*, a term is weighted with respect to other terms in the same section. Sometimes, if a short text is analysed (for example a newspaper article), it is more useful to do this by analysing a term in the *entire text*. Depending on the size of the text, a choice can be made between these three alternatives. In the SDK version of Text Analyst you can choose at what fragment-level you want to conduct the analysis. In the short-term future the possibility to analyse by number of words (e.g. you indicate the size of the fragment to be 100 words) will also be added to Text Analyst.

Step 2 - Processing: *calculation of the semantic weights*

In this stage, Text Analyst ignores stop words that have no added value for the analysis. This means that it analyses them, but only gives them a semantic weight if they co-occur with an important term. For example, in principle the stop words "*of*" and "*the*" are ignored by Text Analyst. However, when they always co-occur with "*president*" and "*USA*", Text Analyst gives a semantic weight to the whole term "*president of the USA*".



In order for a term to be recognised by Text Analyst, several dictionaries tell Text Analyst what to analyse. As Text Analyst analyses the text, it works from both your text and the dictionaries to calculate semantic weights. The dictionaries helps Text Analyst "know" which words to analyse. In total, seven dictionaries are used in the process. However, four of them can be seen and changed by the user. These four dictionaries are:

(1) *User words*: these concepts are the ones you specifically want to be included in the semantic network whether TA finds them to be semantically important in the context of the analysed text or not;
(2) *Common words*: these are words that are assumed to have little semantic importance on their own and are used as modifiers with other semantically important words. Many adjectives, as well as some verbs and nouns are treated by Text Analyst by default as common words. Text Analyst does not analyse common words unless they are combined with another word, creating a semantically important concept;
(3) *Exception words***:** these concepts are words that do not follow usual rules of stemming. Most often, exception words are represented by verbs with irregular verb forms.
(4) *Not analysed words*: these are (stop) words you indicate that should be ignored by Text Analyst.

As mentioned, there are three dictionaries hidden for the user. These dictionaries are comparable with the dictionaries of respectively the *user words*, *common words* and *exception words*. Of course, these dictionaries cannot entail the entire universe of existing terms, so therefore the possibility exists to manually edit any of the visible dictionaries to fine-tune Text Analyst in a certain application domain. For example, if the term "*WMD*" is not recognized by both the *visible* user words and *hidden* user words dictionary, it can manually be added in the visible user words dictionary. To conclude on this point, a particular term that is not recognized by any of the dictionaries is not stemmed and no morphological analysis takes place, unless the user specifies this in one of the visible dictionaries.

Another important step in the processing stage is the *co-occurrence* of terms with one another. In calculating the semantic strength of a co-occurrence, the position of the terms in a fragment is not relevant. So next to the frequency count of the individual terms in the text, the frequency of the co-occurrence with other terms is also counted. This forms the basis of the formula for calculating the absolute semantic weights of the terms, as described below:

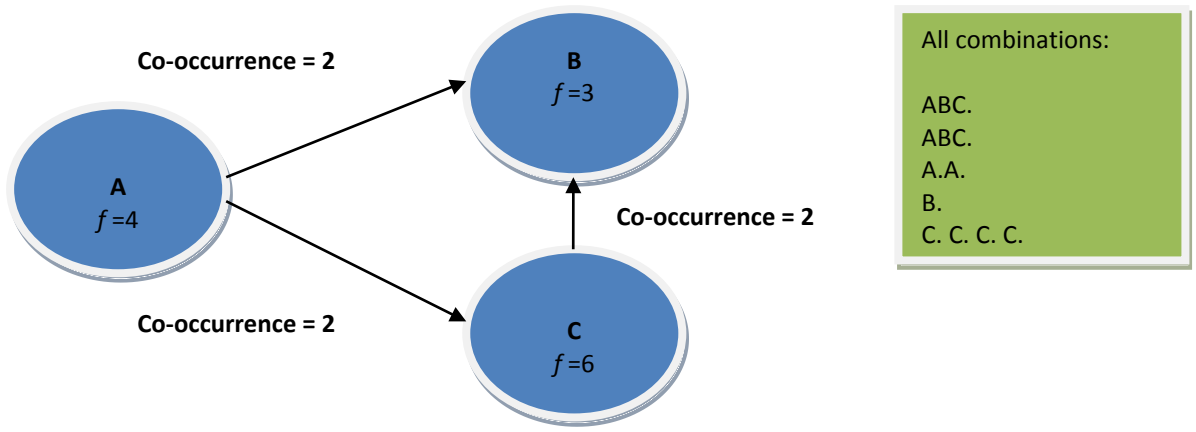


Figure 5.1: Process design of calculating semantic weights

Step 1: For term A, multiply all frequencies (*f*) of all terms that A co-occurs with by the number of co-occurrences A has with those terms, so: (freq. B of 3 × 2 co-occurrences with B) + (freq. C of 6 × 2 co-occurrences with C) = **18**. TA does this for all terms, so for term B (4 × 2) + (6 × 2) = **20** and for term C (4 × 2) + (3 × 2) = **14**. Note that these are the absolute semantic weights.

Step 2: Take the term with the highest *absolute* semantic weight and express all lower absolute semantic weights as percentages of the highest absolute semantic weight. B's 20 is 100%, so A gets (18/20 × 100 = 90% and C gets (14/20) × 100 = 70%. These are the *provisional* relative semantic weights.

Step 3: Repeat this calculation with the semantic weights of all terms instead of the frequencies, because we now only have knowledge about the *semantic weight of the total network around a term*, while we are actually interested in the *semantic weight of the individual term and its relationships*. In this iterative process the differences between the outcomes of the last and the previous rounds will eventually become so small that no significant change occurs anymore. These are the *actual* relative semantic weights.

In this final step, the individual statistical weights of the terms and relations between them need to be adjusted to provide a consistent text representation. The weights of those terms, which are strongly related to other frequent terms in the text should be boosted and vice versa. Therefore, the statistical weights of individual terms to the nodes are assigned in a one-dimensional Hopfield-like neural network where all neurons are completely interconnected (Kharlamov and Ananyan, 2002).

The renormalised weights of terms and relations between them are called semantic weights and the resulting reshaped graph-like structure is called a semantic network (showing the semantically most important terms and their interrelationships).

Note that this example shows that relations are much more important than frequencies. C, the most frequent term, has the lowest semantic value, whereas B, the least frequent term, has the highest semantic weight. In the figure below a typical Text Analyst output is shown. In the example, the National Security Strategy of the U.S. of 2002 was analysed by Text Analyst.

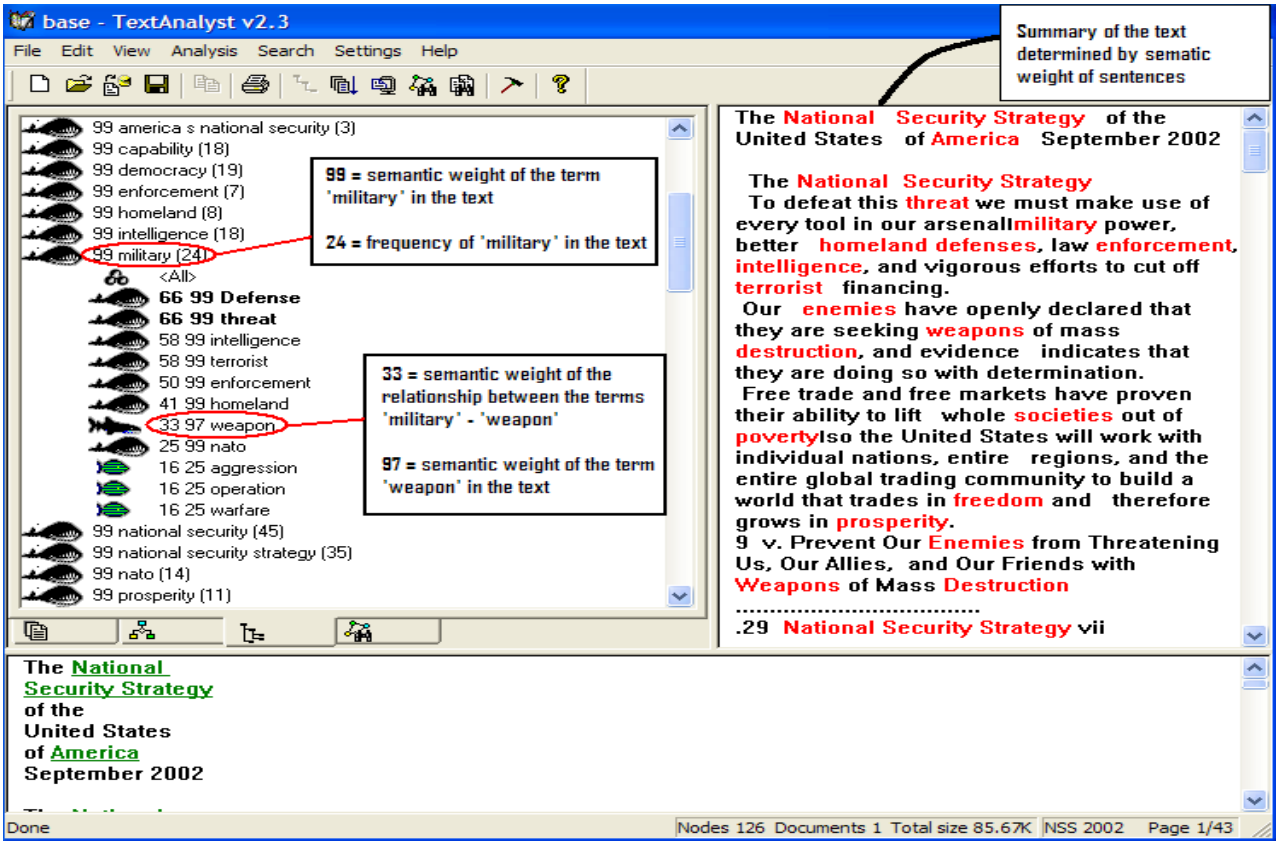


Figure B.1: Snapshot of Text Analyst output

As can be seen in the figure, the terms on the left side of the window are called ‘parents’, while if one clicks on a parent his so-called ‘subordinates’ are seen. For instance, the parent ‘military’ has subordinates ‘Defense’, ‘threat’, […], ‘operation’ and ‘warfare’. In the text boxes in the figure, the explanation of the numbers is given.

Summarisation function of Text Analyst

Notice in Figure B.1 that in the view pane at the right, a summary of the National Security Strategy is given. Figure B.2 displays some statistics about the summary it performed. The percent of text size next to the summary is 12% of the entire document. Text Analyst enables you to summarise the

entire document to a fraction of its size, and still manages to retain significant meaning in the summary.

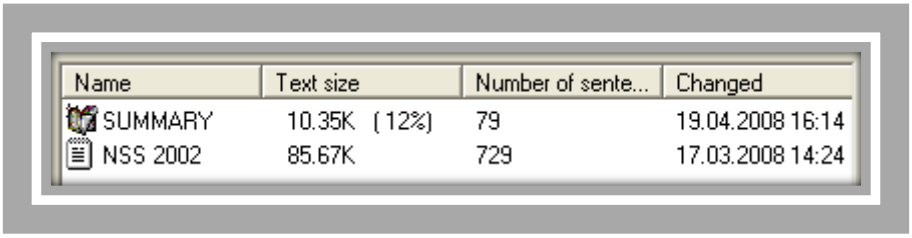


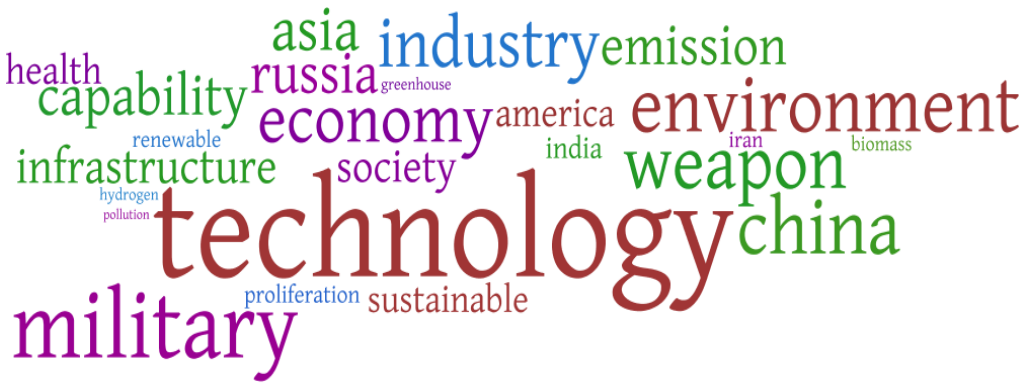
Figure B.2: Summarisation pane of Text Analyst

During the summarisation process, Text Analyst determines the semantic weight of each sentence and displays in the results pane only sentences with a semantic weight higher than the threshold. The default threshold is 90. Thus, currently all sentences with a semantic weight of 90 and higher appear in the results pane.

The summary lists the most important sentences in the context of the original text. The summary chooses the sentences on the basis of concepts and relationships between concepts in the full text. Text Analyst allows you to change the size of your summary by changing the semantic weight threshold. The default as mentioned is 90, so for any summary with the default threshold, all sentences with a semantic weight of 90 to 100 are included, 100 being the maximum height. By increasing the semantic threshold you can decrease the size of the summary. Text Analyst also allows you to view the semantic weights of each sentence in the results pane.

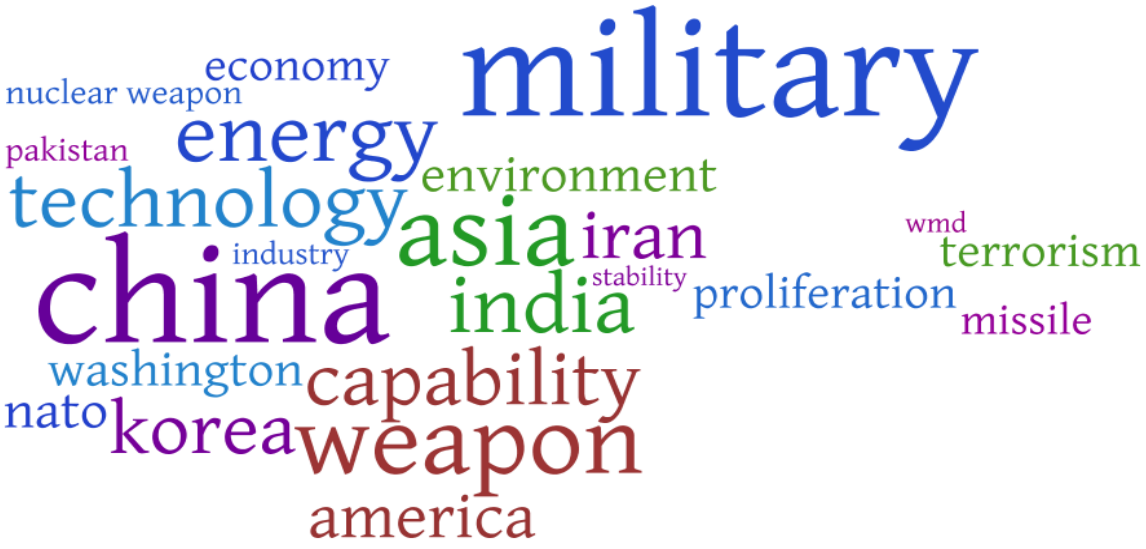
Appendix D: 'Wordles' of themes and sub themes

- **Energy:**



- **China:**

- **Russia:**



- **Saudi (Arabia):**

- **Terrorism:**

- **Weapons:**

- **Nature & Environment:**

- **Health**

- **Technology**

- **Homeland**

- **Warfare**

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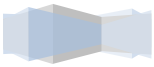

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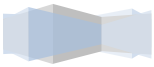

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