A Bayesian Risk Assessment of the Saudi Arabian Oil Supply Chain, 2001-2010

Submitted by David Scott Janczak-Hogarth, to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Arab and Islamic Studies, January 2015.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University

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Abstract

The thesis assesses risks to the Saudi Arabia oil supply chain employing Bayesian methodology. The geopolitical impact of the 9/11 terrorist attacks on the World Trade Centre introduced potential new risks to the Saudi oil supply chain. The thesis will identify a series of risks and determine the likelihood and magnitude of potential disruptions the threats could cause. Thorough testing is undertaken employing Bayesian methodology.

Bayesian methodology assists in discounting implied, overstated and misplaced threats. Data is collected from a number of various sources including current academic literature, experts in the shipping, security and oil field services industry. The data is arranged and the results tested in order to reveal live or benign threats to the Saudi oil supply chain.

Final analysis reveals that there are six major threats to the Saudi oil supply chain, dwindling skilled ex-pat workers, terrorism, new tanker design, a closure of the Strait of Hormuz, Saudi internal instability and developments in technology. The six threats are cross referenced and analysed at depth to determine whether they would individually or combined have a significant disruptive impact on the Saudi oil supply chain.

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Chapter 1

Introduction

Contemporary analysis of the oil industry can quite rightly be accused of focusing on one main issue, namely the risks accompanying high oil prices. However, actors such as political, economic, security and energy market analysts appear to struggle when cross-referencing each other's data.[1] As a result the conclusions, and the factors that influence them, overwhelm the simplicities of traditional 'combining ideas' theories.[2] Instead collectively they form a melange of technical, linguistic and tangential mist from which clarity struggles to emerge. In short some commentators have a tendency to pen emotive as opposed to pragmatic analysis of the risks affecting the global energy supply chain.

The Saudi Arabia oil supply chain is the most successful and long running oil supply chain in the world. The Kingdom has consistently exported oil ever since the supply infrastructure went on line in the 1950's. Throughout the supply chain's history Saudi has adapted to new threats amid periods of intense pressure. The latest raft of threats to challenge the oil supply chain arrived shortly after 9/11. The question had to be asked, just how can the Kingdom mitigate these new risks and overcome the threats they pose? Furthermore, expectations were that the oil supply chain would become a lucrative target for terrorists. The sudden importance of supply chain security attracted acute attention from a wide range of commentators. Unfortunately, as with the global energy supply chain, an alarming proportion of data concerning the Saudi oil supply chain is either implied, overstated, misplaced or technically incorrect. In order to bring clarity to a confused but vital purlieu the purpose is to undertake a Bayesian risk assessment of the post 9/11 Saudi Arabia oil supply chain.

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[1] Baumgartner and Jones argue that 'Experts in all areas spend much of their time convincing others that 'outsides' are not qualified to make decisions in a given area.' See Baumgartner, F and Jones, B.D, *Agendas and instability in American politics,* Chicago, Chicago University Press, 1993, p. 235.

[2] Hadamard wrote 'Indeed, it is obvious that invention or discovery, be it in mathematics or anywhere else, takes place by combining ideas' Zellner, Arnold, *Bayesian and Non-Bayesian Approaches to Scientific Modeling and Inference in Economics and Econometrics,* University of Chicago, 2000, p. 4.

Ultimately the thesis will argue that despite potential threats from flawed technology, dwindling skilled ex-pat workers, terrorism and new tanker designs the two outstanding risks to the Saudi Arabia oil supply chain are from a closure of the Strait of Hormuz and a rise in domestic instability within the Kingdom. The research will not only fill a gap in current literature but also potentially raise the standard of future analysis directed towards 'at risk' supply chains.

Research journey

On the morning of September 11th 2001 I received a text message from a friend of mine working in the United States of America. The text stated that the World Trade Centre had been attacked and that I should turn the television on. I had just arrived home from a shopping trip so I switched the TV on and remained stunned in front of it for the next six hours. For my generation 'where were you on 9/11?' was as synonymous as asking the previous generation where they were when Kennedy was assassinated. The following week I began my undergraduate degree in Peace Studies at the University of Bradford during which not surprisingly 9/11 and the subsequent reverberating global events dominated the programme and, if I may boldly state, a great deal of ongoing global policy fourteen years on. My immediate thoughts however, along no doubt with many others, were how 9/11 would impact on world oil?

At Bradford I broke somewhat with new found 9/11 tradition and chose to focus on my own interest, that of oil and the relationship between society and oil, encompassing among other topics: politics, economics, cultural impact, logistics and the huge engineering projects required to keep oil flowing. My undergraduate dissertation produced a study on the impact of the oil industry on the remote island of Sakhalin in the Russian Far East. I had to assess whether an oil spill could be contained, the risks surrounding operating a floating drilling rig and how the oil industry would affect the inhabitants of such a remote island.

When choosing a suitable topic for my PhD the Saudi Arabia oil supply was an unchallenged first subject of choice. The Saudi Arabia 'KSA' oil supply has managed to weather everything that has been thrown at it, the oil markets pulmonary artery. At the time 9/11 was still dictating policy and there was still a great deal of 'unknowns'

such as the stability in Iraq and Afghanistan not to mention the true operative capability of Al Qaeda. Tehran was also pressing forward with Iran's nuclear ambition during which Washington cooled towards Riyadh. I saw the opportunity to invert the topic of my undergraduate degree and look at society driven risks to the KSA oil supply chain that emerged after 9/11 whether they be for example political, economic or technical in nature.

I wanted to examine the nature of risks, not only the possibility of a threat occurring but the actual likelihood of the threat being executed. Also whether everyday 'working' risks are more or less containable than say an act of terror? I also wanted to pose the 'what if' question to scenarios that were taken for granted as being out of the question impossibilities to achieve. The roots of 9/11 were supposedly reaching everywhere and everything. I took the view that a risk analysis of the KSA oil supply chain, a vital conduit of global security, would be a justifiable topic – not to mention a plausible topic in depth, scope and content for a thesis.

The scope of the thesis would cover the oil supply chain from drilling in the oil fields to export via oil tankers into the Gulf and out into the ocean via the Strait of Hormuz. I knew that data would not come from traditional international relations/international security areas but instead gathered from industry sources. I was also aware that industry sources would contain less data on the political nature of risk and academic sources would provide a reduced technical content. At this early stage a high priority was to choose a suitable methodology.

During my initial reading I discovered a suggestion by respected Middle East expert Anthony Cordesman who suggested that

> **'There is a clear need for an assessment of...some form of Bayesian approach to risk analysis.'**[3]

I researched the possibility of adopting Bayesian methodology, a full description of which can be found later in this chapter. Cordesman's suggestion together with the

[3] Cordesman, Anthony H, Al-Rodhan, Khalid, *The Global Oil Market: Risks and Uncertainties,* CSIS, Washington DC, 2006, p. 20.

suitability of adopting a Bayesian approach to risk analysis became the rationale for choosing a Bayesian methodology as being an appropriate choice. As with most PhD scholars my research would however be limited to available resources.

The purpose of the research

The purpose of the thesis is to identify short, medium and long term risks to the supply chain between September 11th 2001 '9/11' and December 31st 2010. The thesis will also highlight chronic, acute and benign factors that threaten it between these two dates. Furthermore, the thesis will expose and separate implied from probable areas of risk.

The timescale of just over nine years in which the thesis is set is justified as being a significant and authoritative period of time after the 9/11 Terrorist attack in New York to assess the scope, impact and longevity of any subsequent threats and risks to the Kingdom of Saudi Arabia 'KSA' oil supply chain. Therefore the December 31st 2010 finish date of the thesis is not significant other than to draw a suitable end to the scope of the study. The thesis does not however attempt to make a direct connection between the events of 9/11 and threats to the KSA oil supply chain.

The resulting post 9/11 paradigm shift[4] in global security produced an eristic aura in which very few key securities that had been taken for granted before the attack could, it would appear, be relied upon during the immediate and long term aftermath of the attack. It is from this mise en scène that the thesis draws its purpose. The KSA oil supply chain had become an industry stalwart. Furthermore the oil market had become accustom to the unquestionable reliability the supply chain offered clients.

[4] The concept of a post 9/11 paradigm shift has been well argued with in academia. See Johnson, DDP & Madin, EMP (2008) Paradigm shifts in security strategy: why does it take disasters to trigger change? In: Natural Security: A Darwinian Approach to a Dangerous World (eds. RD Sagarin & T Taylor), Berkeley and Los Angeles, CA: University of California Press.

The principle focus of the thesis

Taking into account the question mark which the US placed over Saudi Arabia and the wider Middle East immediately after 9/11, would the ongoing resilience of the KSA oil supply chain be challenged by any subsequent geopolitical or other unknown unspecified actions or events? The principle focus of the thesis is to identify, assess and quantify significant threats and risks which pre-existed or evolved after 9/11 and continued to be an issue before 2010, or continued during and/or after the stated timeframe. The thesis will therefore focus on assessing and quantifying the potential impact of the identified risks which emerged during the stated timescale. To determine the scale of the identified risks they will be assessed and analysed in order to quantify their potential impact to the oil supply chain.

A key purpose of assessing risks will be to determine the realistic likelihood of a sustained threat, as opposed to quantifying the risk emanating from an implied threat that proves to be exaggerated or baseless. Implied threats also encompass technically incorrect threats which are put forward in theories. One area in which technically incorrect threats stood out occurred when commentators referred to the tanker shipping industry, an industry firmly entrenched in international relations, although experts in this area often overlook the decisive technical issues which may cause oil tankers to place the supply chain at risk.

Bayesian approach to risk analysis

As mentioned earlier in the 'research journey' the thesis has adopted a Bayesian based methodology. Below is an explanation of Thomas Bayes who discovered Bayes theory, a description, with examples of Bayes theory and a justification that Bayes theory can be utilized for qualitative research despite being initially developed for quantitative data.

Thomas Bayes

Thomas Bayes was a Presbyterian minister and mathematician who lived in England in the 1700's (born circa 1702 and died April 17, 1761).[5] 'Reverend Bayes, as he is commonly referred to, lives on in the characterisation of modern statistical methodology as a consequence of the publication of 'An essay towards solving a problem in the doctrine of chances'.[6] The essay was posthumously delivered by Richard Price to the Royal Society in 1763 – three years after Bayes death.

Bayes essay explained how to accumulate information to revise estimates of probability. By 'accumulate information' Bayes described a process in which the assessor continually revises a probability estimate as more information comes in.[7] JJ Martin summarised the origin of Bayes proposition as

> **[Bayesian Theory]...is a ...structure which guides a decision maker in choosing a course of action in the face of uncertainty about the consequences of that choice. The course of action recommended by the theory is one which is consistent with the decision maker's preference for various consequences and his considered judgement about the uncertainties involved in the problem.[8]**

The technical result at the heart of essay is what we now know as 'Bayes theorem'[9] or 'Bayes theory'

Bayes theory – a brief introduction

The reasons for choosing Bayes theory as a methodology for this thesis have been outlined above in this chapter, and a more detailed explanation and definition of the theory will follow in Chapter 3. Available literature contains an abundance of examples and explanations of Bayes theory, the majority are highly technical mathematical

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[5] James Press, S, *Bayesian Statistics: Principle, Models, and Applications,* John Wiley and Sons, New York, 2000, p. 15. Also see Howell, David C, *Statistical Methods for Psychology,* Thomson, London, p 121.
[6] Bernado, Jose M, et al, *Bayesian Theory,* John Wiley and Sons, New York, 1998, p. 2.
[7] Howell, David C, *Op cit,* p. 121.
[8] Martin, JJ, *Bayesian Decision Problems and Markov Chains,* Krieger, New York, 1987, p. 8.
[9] Bernado, Jose M, et al*, Op cit,* p. 2

problems such as those posed by Martin, Denison, Holmes, Mallick, Smith, Maritz, Lwin and Smith.[10] However, the thesis would benefit at this stage from a straightforward example[11] of applying Bayes theory as stated by the 'Economist'.

> **The canonical example is to imagine that a precocious new born observes his first sunset, and wonders whether the sun will rise again or not. He assigns equal prior probabilities to both possible outcomes, and represents this by placing one white and one black marble into a bag. The following day, when the sun rises, the child places another white marble in the bag. The probability that a marble plucked randomly from the bag will be white (i.e. the child's degree of belief in future sunrises) has thus gone from a half to two-thirds. After sunrise the next day, the child adds another white marble, and the probability (and thus the degree of belief) goes from two-thirds to three-quarters. And so on. Gradually, the initial belief that the sun is just as likely as not to rise each morning is modified to become a near-certainty that the sun will always rise.[12]**

Or as further reduced by Saini[13]

> **[C]alculates the odds of one event happening given the odds of other related events.**

David Howell provides a further explanation of applying Bayes theory to a problem which assesses a constant supply of data in order to be solved

> **Suppose I tell you that Fred was murdered and ask you for your personal (subjective) probability that Willard committed the crime. You think he is certainly capable of it and not a very nice person, so your probability increases. Then I say that Willard was seen near the crime that night, and you raise your probability. Then I say that Willard owns the right type of gun, and you raise your probability again. Then I say that a fairly reliable witness says Willard was at a baseball game with him at the time so you drop your probability. This is a process of accumulating information to come up with a probability that some event occurred.[14]**

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[10] Martin, JJ, *Bayesian Decision Problems and Markov Chains,* Krieger, New York, Denison, G T, Holmes, Christopher C, Mallick, Bani K, Smith, Adam, FM, *Bayesian Methods for Nonlinear Classification and Regression,* Wiley, London, 2002. Maritz, JS, Lwin, T, *Empirical Bayes Methods,* Chapman and Hall, London, 1989. Bernado, Jose M, Smith, Adrian FM, *Bayesian Theory,* Wiley, London, 1989.

[11] A more formal example can be found in Martin, JJ, *Bayesian Decision Problems and Markov Chains,* Krieger, New York, p. 8.

[12] http://www.economist.com/node/382968

[13] Saini, Angela, *A Formula for Justice,* http://www.theguardian.com/law/2011/oct/02/formula-justice-bayes-theorem-miscarriage

[14] Howell, David C, *Op cit,* p. 121.

So how do these examples relate to applying Bayes theory to numerous potential threats to the KSA oil supply chain? Assessing the threats by analysing the opinion of experts and evidence based data will either discount benign threats or highlight likely threats depending on whether they emerge. For example, an implied threat could remain prevalent for some considerable time but may never emerge because the subsequent investigation, evidence and assessment revealing the threat to being inconceivable to deliver – drawing a pun from the above example – a threat from which the sun never arises.

Bayes theory – assessing qualitative over quantitative data?

At first glance Bayes theory may give the opinion that its application has been for quantitative mathematical data, but since the theory has been introduced over 230 years ago Bayes theory is widely accepted as being applied to assess qualitative data bases – MA Meadow, *A Quantitative Approach to Bayes Theorem,* Gundrun Socher, *Bayesian Reasoning on Quantitative Reasoning from Images and Speech,* are but two proponents. Denison et al state, 'We should clearly be able to improve the quality of models we develop by incorporating whatever...qualitative knowledge we have available.'[15] Jack Buckley further argues about Bayesian qualitative research,

> **Mixed-methods research has a long tradition in the evaluation of social programs and public policies (Reichardt and Cook 1979), where the combination of qualitative and quantitative inquiry has long been regarded as a necessity (cf. Lincoln and Guba 1985). One reason for this is the context and intended audience of evaluation research: in addition to the techniques of on-site observation and in-depth interviews popular in qualitative policy evaluation.[16]**

The mention of on-site observation and in-depth interviews are well placed to compliment the wider operative basis of this thesis set out in the research journey earlier in this chapter.

[15] Denison, David G T, et al *op cit,* p. 5.
[16] Buckley, Jack, *Simple Bayesian Inference for Qualitative Political Research,* Boston College, Boston, 2009, p 1.

A more exacting use of qualitative data in Bayes theory is found in medical research. The impact of disease on a certain area has for example been calculated using qualitative data.

> **While decisions made according to Bayes' theorem are the academic normative standard...the principles can be followed without intimidating mathematics. To do so, one can first categorise the prior-probability of the disease being tested for as very unlikely (less likely than 10%), unlikely (10-33%), uncertain (34-66%), likely (67-90%) or very likely (more likely than 90%)...The simplicity of the method, while still adhering to the basic principles of Bayes' theorem, has the potential to increase its application in clinical practice.[17]**

The thesis will adopt a similar approach made by Meadows in order to calculate low, medium and high disruptions to the KSA oil supply. Despite Bayes theory being associated with quantitative data, the thesis, backed up by evidence of previous robust qualitative Bayesian research by other scholars, will confidently adopt a qualitative data approach in this thesis. Research for this thesis will construct a network of factors that organize the supply chain by mapping out cause and effect relationships among key variables discussed in Chapter 4 in order to produce a prior distribution (see fig 1.1 below).

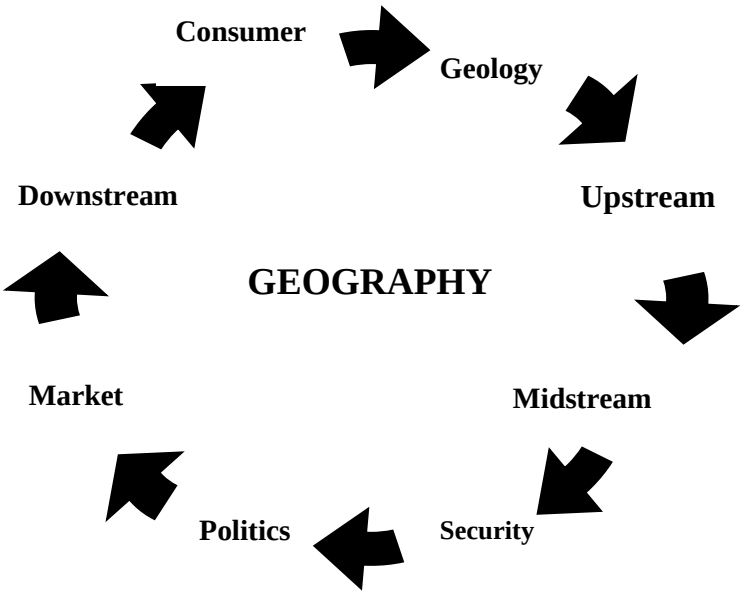

Fig 1.1 Key variables diagram

[17] Meadows, MA, *A Quantitative Approach to Bayes Theorem,* http://www.ncbi.nlm.nih.gov/pubmed/21862499, 2013.

The thesis will also not set out to compare competing research methods or theories on the subject. The thesis will draw together several areas of expertise which currently 'standalone' as separate disciplines. For example the oil field service industry commits research into security issues, as does the shipping industry but the two industries see no need to combine their findings as they are seen as irrelevant to one another. The conclusion therefore will be solely based on evidence collected and analysed while researching the complete 'from oil well to export by sea' supply chain – an exercise that is distinctly lacking in current literature. The exercise will not only appraise the threats, but more importantly gain insight into the dynamics required to prevent the threats from becoming critical.

Defining the problem: the geopolitics of energy

The geopolitics of energy are rarely static. Existing responses, including those discussed above, aimed at reducing risk and mitigating the impacts of incidents has tended to be based on static models that generate preventative and defensive measures. There is a growing need for dynamic assessments that can adapt and develop if the threat grows[18]. The thesis will introduce geopolitical threats as the concept for calculating risk. The underlying reason for adopting this principle over other factors is in the belief that geopolitics 'preoccupy business and governments around the globe'[19] Daniel Yergin expands on the dilemma for the energy sector,

> **'Although Energy Companies will be prospecting in more difficult environments, the major obstacle to the development of new supplies is not geology but what happens above ground: namely, international affairs, politics, decision-making by governments, and energy investment and new technological development. It should be noted, however that current projections do show that after 2010 the major growth in supplies will come from fewer countries than it comes from today, which could accentuate security concerns'**[20]

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[18] Van der Linde, Cory, *Study on Energy Supply and Geopolitics-Final Report,* Clingendael International Energy Programme, Institute for International Relations, January 2004, p. 17.
[19] Verrastro, Frank, *Comments and Observations on the topic of U.S. Energy Independence,* Testimony before the Committee on Energy and Natural Resources United States Senate, Washington DC, 07/03/06, p. 1.
[20] Yergin, Daniel, *Ensuring Energy Security,* Foreign Affairs, Vol. 85, No. 2, Washington DC, 2006, p. 75.

Yergin's warning that the focus of geopolitical interest will eventually fall on regions holding abundant reserves should not be taken lightly. By 2030 global demand for primary energy (oil and gas) is expected to rise by over 60%. The Gulf States collectively hold two-thirds of the world's oil reserves.[21] They also 'want to see their respective fields developed to maximize production over 50 years or more'[22], and are expected to account for most of the future demand.[23]

The international community should therefore be increasingly more conscious of the need to develop new energy security strategies. Above all there is a duty to protect global energy supplies in resource rich countries that are becoming increasingly more unstable and prone to acts of terrorism. Michael Ross[24] argues that conflict is linked to such factors as the price of energy, socio-economic stability, government policy and the 'culture of dependency' between major producing and consuming states.[25] The security of the supply infrastructure and the political and economic stability of supplier states is consequently of major concern.[26] An ongoing threat to the security of oil and gas supplies is the impact of the above factors on major exporting and transit states,[27] and consequently it is of growing importance that the political climate in exporting countries[28] is monitored.

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[21] For a comprehensive appraisal of Saudi reserves see Cordesman, Anthony H, *US and Global Dependence on Middle Eastern Energy Exports: 2004-2030,* CSIS, Washington DC, 2004.
[22] Marcel, Valerie, *Investment in Middle East Oil: Who Needs Whom?* Chatham House, London, 2006, p. 3.
[23] Caruso, Guy F, *The Geopolitics of Energy into the 21st Century,* Senate Energy and Natural Resources Committee, Washington DC, 21/03/06.
[24] See Ross, Michael, *How Do Natural Resources Influence Civil War? Evidence from 13 Cases,* UCLA, Los Angeles, 2003, p. 36-37. Ross, Michael, *The Political Economy of Resource Curse,* World Politics, 51, 1999, p. 307. Ross, Michael, *Does Oil Hinder Democracy?* World Politics, 53, 2001, p. 337-340.
[25] Simon Bromley also argues that the US faces a long term future of geopolitical competition with China, India and possibly Russia. See Bromley, Simon, *The United States, Hegemonic Strategies and World Oil,* St. Anthony's International Review, Vol. 2, No. 1, STAIR, Oxford, 2006, p. 64.
[26] See Franssen, H.T, *Oil Security through 2010,* CSIS, 2002, p. 64.
[27] Abadie, Alberto, *Poverty, Political Freedom, and the Roots of Terrorism,* Harvard University and NBER, October 2004.
[28] Levinsky, Steven, Way, Lucan A, *The Rise of Competitive Authoritarianism,* 'Journal of Democracy', April 2002.

Sudden events

Winston Churchill mused that 'Safety and certainty in oil lie in variety and variety alone.'[29] Sudden events in the Gulf have given a paradoxical twist to his theory by revealing how conflict and uncertainty produce 'variety' in the market. To date there has not been a single event in the history of Middle East oil production that has been powerful enough to completely stop the supply chain.

Oil and gas has continued to flow from the Gulf regardless of threats from revolution, war, terrorism, embargos and field depletion to name but a few. In particular the US has a vital interest in ensuring a safe and unimpeded supply of energy not just to America, but to the world markets as well.[30] Where the supply chain has been previously weakened for example during the 'tanker war'[31] the attempt to stop exports proved unsuccessful, largely due to foreign intervention.

Supply chain literature

One area that deserves special attention is the gap often found in supply and demand research. Ross and other scholars are noticeable for their absence of in depth analysis of the role oil and gas tankers play in the supply chain. A review of recent literature by Kalicki and Goldwyn, Barnes and Jaffe, Luft and Korin, Klare, Fawcett, Halliday, Yergin, Mitchell, Marcel and Cordesman is telling.[32] Chapters devoted to supply issues are often filled with production and demand data. The impact of escalating country risks, declining spare production capacity, strikes, sanctions and embargos are all vigorously argued but fall short of charging the full equation. Where

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[29] Yergin, Daniel, *op cit*, 2006, p. 69.
[30] Barnes, Joe and Jaffe, Amy Myers, *op cit,* 2006: 145.
[31] The 'tanker war' will be examined later in the paper.
[32] Kalicki, Jan H and Goldwyn, David, *Energy Security: Towards a new foreign policy strategy,* Woodrow Wilson Center Press, Washington D.C, 2005. Barnes, Joe and Jaffe, Amy Myers, 'The Persian Gulf and the geopolitics of oil', *Survival,* 48 (3) Spring 2006: 143-163. Luft, Gal and Korin, Anne, 'Terrorism Goes to Sea', *Foreign Affairs,* November/December 2004. Klare, Michael, *Blood and Oil,* Penguin, London, 2004. Fawcett, Louise (Ed), *International Relations of the Middle East,* Oxford University Press, Oxford, 2005. Halliday, Fred, *The Middle East in International Relations,* Cambridge University Press, Cambridge, 2005. Yergin, Daniel, *op cit*, 2006, p. 69-82. Mitchell, John, et al, *The New Economy of Oil: Impacts on business, Geopolitics and Society,* London, RIIA, 2005. Marcel, Valerie, *Oil Titans,* Chatham House, London, 2006. Cordesman, Anthony, *Energy Developments in the Middle East,* CSIS, Washington DC, 2004.

threats to the infrastructure are discussed, attacks on pipelines are the predominate issue. Such analysis is benign without considering the role of oil and gas tankers. Unfortunately, in cases where tankers are discussed, the reasoning can be oblique or based on supposition.[33] The net effect leans towards smoke and mirrors. The reader is led to believe that individual producer states can fail for one reason or another but pride and trust in the international delivery of oil and gas, regardless of any crises, is a foregone conclusion

The method and structure of the thesis

Chapter 2 analyses historical disruptions in the Gulf. The analysis and data draw attention to patterns which develop as a result of these disruptions. While not delving too far into the methodology, H Bradford Westerfield argues that 'One way to test the usefulness of Bayes' Theorem...is to...replay history.'[34] An exercise held within this chapter. Westerfield further argues that effective assessment usually occurs after changes to the *status quo* have occurred[35]. A key finding is that in order to compensate for the threats that cause disruptions the supply chain often, as a result, develops new challenges which it must overcome – often in patterns. The continual introduction of new threats is a prime reason for employing Bayesian methodology.

Chapter 3 introduces Bayesian methodology. A full explanation sets out how the thesis will benefit from the flexibility and analytical aspects of the methodology. The chapter also contains a report of the field trip I made to Dammam where I attended the 2008 SAOGE (Saudi Arabia Oil and Gas Exhibition). During my visit I recorded several interviews, excerpts of which can be found in the thesis. The full transcripts are placed in the appendices.

In chapter 4 the chosen Bayesian methodology will be tested against a data set in order to produce a posterior distribution. The process is explained in the empirical

[33] For a prime example of a respected energy analyst misunderstanding the impact of a hypothetical incident see Yergin, Daniel, *op cit*, 2006, p. 79.
[34] Westerfield, H. Bradford, *Inside CIA's Private World*, Yale, London, 1995, p. 258.
[35] *Ibid*

stage of the research framework fig 1.2 below,[36] where 'Design' is the prior distribution and 'Test hypotheses' is the posterior distribution.

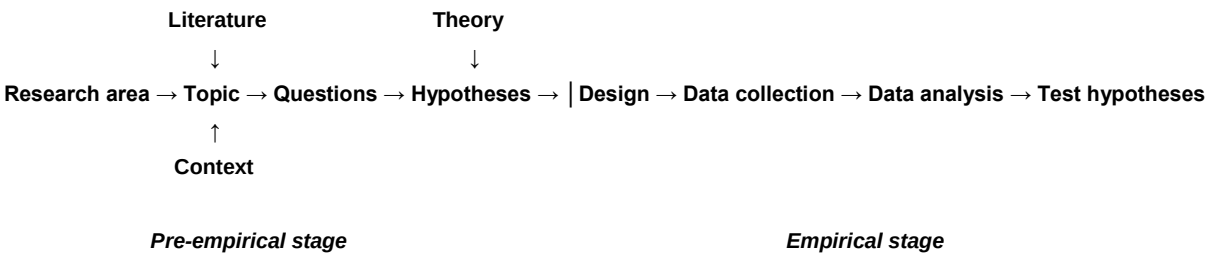

Fig 1.2 Research framework

In chapter 5 the posterior distribution generated in Chapter 4 will be reconstituted to form the final prior distribution. A new data collecting design will also be introduced. The new design will switch attention away from amassing data and focus instead on drafting prior distribution questions, that when answered in Chapter 6 will reveal the likelihood of a threat materializing, and where appropriate, the extent of the disruption to the KSA oil supply chain.

Chapter 6 analyses the final prior distribution, containing potential threats from technology, dwindling skilled ex-pat workers, terrorism, new tanker design, the closure of the Strait of Hormuz and domestic instability within Saudi Arabia. At the end of the chapter the reasons why the first four potential threats listed above are discounted. There then follows reasons why the Strait of Hormuz and domestic instability within Saudi Arabia are retained as the greatest potential risks to the Saudi Arabia oil supply chain.

Chapter 7, the concluding chapter rounds off the thesis with a statement on the empirical findings from the thesis. An account of how the research question was answered. Following this, the theoretical implications will be argued pointing to areas that conflicted with current thought. A closing section will then address several policy implications where the research had exposed ideas to aid the decision making process.

[36] Punch, Keith F, *Introduction to Social Research Quantitative and Qualitative Approaches (Second Edition),* Sage, London, 2005, p. 40.

Chapter 2

Gulf geopolitics and the oil supply: a historical analysis of major disruptions

Introduction

Oil has performed a crucial but often troubled role in the progress of the developed world.[37] The domestic and foreign policies of major oil consuming states are often considered superfluous when applied to oil producers. The catalogue of problems that can arise from enacting these policies have been well documented in academic and industrial literature, but for the purposes of this study it can be reduced to the following core issues:

1. Major Western consumer states are largely responsible, historically, for fixing the boundaries of producer states. The boundaries often bisected long-established tribal areas, the inhabitants of which have never fully identified or integrated with their adoptive country.
2. Consumer states have consistently increased their investment in technology which is transported to and operated inside producer countries. The majority of producer countries maintain poor social and private investment opportunities, resulting in the technological marginalisation of their indigenous population.
3. Consumers are by and large diametrically opposed to the cultural, religious and political ideologies of their producer partners.
4. Consumers trade arms with producers on the silent understanding that oil will be exported regardless of any internal strife.
5. The oil industry commands huge start up and production costs that have led to mismanagement of revenues and corruption among officials.
6. The tanker industry provides a reliable and largely independently owned service to the oil industry. A fact that is often overlooked by commentators analysing energy security is that tankers are paramount to the oil market, in that traders rely on charterers[38] to hire seaworthy tankers with reliable crews to physically

[37] Juan Pablo Perez, the Co-Founder of the Organization of Petroleum Exporting Countries (OPEC) referred to oil as 'the devil's excrement'.
[38] An individual or company that hires a ship.

deliver contracted oil to its bid destination, in order for confidence in the market to endure.

7. Tanker chartering has been cited by economists as one of the very few examples of 'perfect competition'.[39] The price is set by negotiation between the buyer and seller of the service without regulation or rules. Tankers themselves operate under little government or international regulation and generally employ crews consisting of personnel from the third world. The combination of these factors has however promoted an air of ruthlessness and unaccountability among industry outsiders.
8. The price and amount of oil in a conflict area can intensify the struggle for control of the oil fields, which are usually located away from the State capital. The physical and cultural distance between interested parties at each end of the dilemma has the potential to fuel simmering internal unrest.
9. Tanker owners have so far avoided blame for lifting (loading) oil out of conflict areas where oil exports have traditionally prolonged wars and/or embargos. The blame is usually directed towards importing governments, by their predominantly (moralistic) middle class voting public. The same middle classes tend not to accept that they share the blame as end users of oil, but are often eager to attribute blame to the end users of alcohol, tobacco and illegal drugs for their addictions, due to a commonly held belief that it is an addict's 'own fault' for getting hooked in the first place.
10. End users of crude are more inclined to identify with crude's refined products than they identify with oil. In many producer states the situation is reversed.
11. The threat of conflict, terrorism and political violence in and among producer states invariably has far reaching consequences for all concerned.

At any one time a single or combination of the above points are ongoing in a multitude of locations worldwide. The oil market is a singular global market therefore knowledge about producers and consumers current state of affairs is vital to the universal security of all concerned. Producers and consumers alike have struggled to find solutions to these complex problems, leaving the oil industry to hang in the balance:

[39] Newton, John, *A Century of Tankers: the tanker story,* Intertanko, London, 2002, p. 52.

> **The politics, economics, and social dynamics that shape these threats are complex. They are driven by political and security issues, but they are also driven by economic and demographic factors and a wide range of cultural factors. It is also dangerous to generalize.[40]**

The oil industry has continually adapted to new, and often equally troublesome, diversions to its infrastructure. The primary reason for these diversions is disruption to the oil supply.

The Gulf exports more crude than any other oil producing region in the world. The region is one of the world's most troubled areas. The oil/conflict relationship has driven a long running debate centred on whether oil or regional issues fuel conflict in the region. The exact cause of conflict may not be clear but regardless of the arguments Gulf exporters and major importers place oil security at the top of their agendas:

> **It is more a question of the regional geopolitics of oil in the context of global trends that is significant…the three main trends in oil security are, first, that most of the industrialized world has long been dependent on oil imports; secondly, that the United States and China are also becoming rapidly more dependent on oil imports; thirdly, most of the remaining oil is in and around the Persian Gulf. In short there will be a scramble for the control of African oil reserves and Russia may use its oil-exporting power for a variety of political ends, mainly concerned with regaining an element of great power status after the collapse of the 1990's. Even so, this is not 'where it's at, so to speak. The Persian Gulf is the focus and will remain so.[41]**

Conflicts in the region have led to frequent disruptions to the oil supply. The disruptions are an increasing worry for oil exporters and importers alike, due to their size and impact on the world economy. This chapter will chart the chronology of threats to the region and discuss how these threats affected the oil supply. Recent events have introduced new threats to the Gulf. The author will conclude by highlighting new areas of risk for closer analysis.

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[40] Cordesman, Anthony, *The Changing Dynamics of Energy in the Middle East: volume 1,* Praeger, London, p. 65.

[41] Rogers, Paul, *Why We're Losing the War on Terror,* Polity, London, 2007, p. 142. Anthony Cordesman also holds this opinion; Cordesman, Anthony, *The US Military and Evolving Challenges in the Middle East,* CSIS, Washington D.C, 2002, p. 1.

Gulf based oil companies

Six of the world's ten largest oil companies are located in the Gulf. They are all State owned entities collectively owning over 60% of the worlds known oil reserves (see table below).

Company	Oil and Gas Reserves (1)	Oil Reserves (2)	Oil Production (3)	Total Revenues (4)
Saudi Aramco – Saudi Arabia	**299.8**	**259.4**	**8.9**	**122**
NIOC - Iran	**287.9**	**125.8**	**3.9**	**32.5**
QGPC - Qatar	**172.1**	**15.2**	**0.7**	**12.6**
INOC - Iraq	**134.0**	**115.0**	**2**	**12.1**
ADNOC – Abu Dhabi	**126.0**	**92.2**	**2**	**17.5**
KPC - Kuwait	**99**	**99**	**2.3**	**25.2**

Fig 2.1 The Largest National Oil Companies (as of December 31, 2004)[42]

The oil industry is split into three distinct sectors:

1. Upstream: the upstream sector includes exploration, drilling exploratory wells, and operating the wells that recover and bring the crude oil to the surface. The upstream sector is often referred to as the 'exploration and production' (E&P) sector.

2. Midstream: the midstream sector processes, stores, markets and transports crude oil. The evolution of the midstream has seen the greatest commercial risk but remained the most dynamic and challenged of the three sectors. The mid-stream could be said to attract difficulties because of the size, ownership and commercial competition within the sector's infrastructure.

[42] Maugeri, Leonardo, *The Age of Oil,* Praeger, London, 2006, Appendix 4.

3. Downstream: the downstream sector includes oil refineries, petrochemical plants, petroleum product distribution, retail outlets and natural gas distribution companies. The downstream industry produces products such as gasoline, diesel, jet fuel, heating oil, asphalt, lubricants, synthetic rubber, plastics, fertilizers, antifreeze, pesticides, pharmaceuticals, natural gas and propane.

To use an analogy, substituting the human body, the lungs become oil reserves, tankers are blood corpuscles. Oxygen is oil carried in the corpuscles and pumped through the heart which is a combination of demand and the economy. The oxygenated human brain acts as the government. The stomach, intestines, liver and kidneys substitute for refineries that feed the body and also dispose of the waste. The key to life and good living is common to both the oil industry and the human body. The brain must not allow the actions committed by a healthy nourished body to interfere with the life support system so it develops policies. These policies are the key to survival as they can lead to among other things, strength, stress and depression on any one organ or the body as a whole.

Geology and recovery methods

One common assumption concerning the Gulf is that oil literally poured out of the ground, which although technically correct in isolated areas, it is a semi-myth that needs further explanation. For example, engineers have explored over a dozen rock formations in Saudi Arabia, although surprisingly, only a few of these formations that were expected to have oil deposits ever produced a significant amount of oil:

> **Saudi Arabia's Jurassic-age Arab carbonate rock formation has produced almost all the highly valued light and extra light oil in Saudi Arabia…On the long list of known geologic formations in Saudi Arabia , the Arab formation is almost hard to find. This remarkable reservoir rock is divided into A, B, C and D zones. Virtually all the oil produced…has come from the Arab D oil column…In total, the Arab D oil column was commonly about 250 feet thick at locations near the centre of the field and grew thinner towards the edges of the field, or flanks, where it was in contact with the underlying aquifer, referred to as the oil/water contact.**[43]

[43] Simmons, Matthew, *Twilight in the Desert,* Wiley, Hoboken, 2005, p. 21.

More often than not once the drill pierced the deposit pressure alone forced the oil upwards. Later on, engineers pumped desalinized water or gas down the well which in turn built up pressure underground and forced up the oil. The oil/water mix was separated from the gas with the oil being run off for processing and the water and gas reintroduced back into the well (see diagram below). Other recovery methods include water flooding, whereby water is injected into a depleted oil reservoir so that the water sweeps some of the remaining oil to nearby producing wells. Chemical flooding follows the same methodology as water flooding except that chemical flooding can only be used for sandstone reservoirs (due to absorption issues), and employs a cocktail of different fluids to flush out the remaining oil.[44]

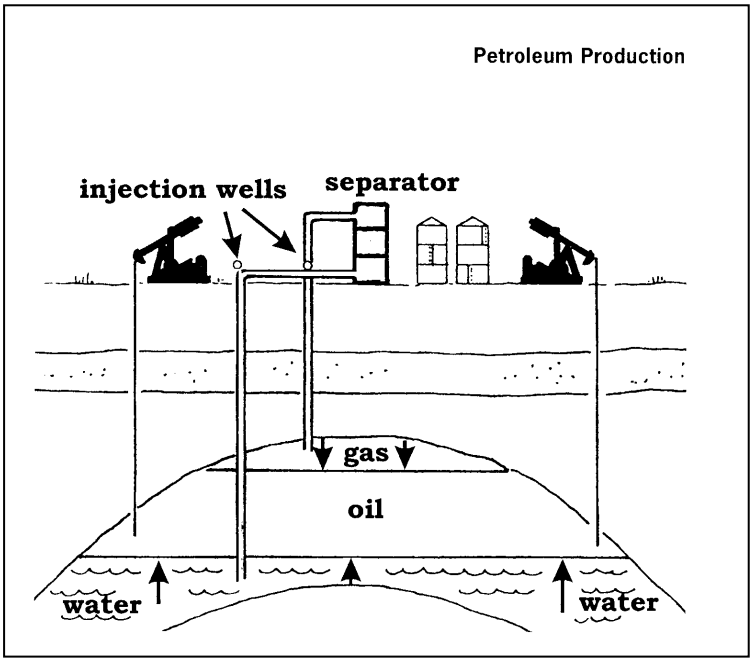

Fig 2.2 Oilfield Brine and Solution Gas Disposal Diagram[45]

[44] Hyne, Norman, J, *Nontechnical Guide to Petroleum Geology, Exploration, Drilling, and Production, 2nd Edition,* PennWell Corporation, Oklahoma, 2001, p. 445.
[45] Hyne, Norman, J, *ibid,* PennWell Corporation, Oklahoma, 2001, p. 427.

Reserves

Reserves are those quantities of oil which are anticipated to be commercially recovered from known accumulations from a given date forward.[46] The reserves quoted are as accurate as possible given the amount of reliable geologic and engineering data available at the time of the estimate. The relative degree of uncertainty that accompanies reserve estimates may be conveyed by placing reserves in to one of two principle classifications, proved or unproved. Unproven reserves are less certain to be recovered using technology available at the time of the estimate than proven reserves are. It is left to the discretion of the countries or companies involved to make public their unproven reserves. Proven reserves may be further sub-classified as probable and possible reserves, to emphasize the progressively increasing uncertainty in their recoverability. Reserves estimates will generally be revised as additional geologic or engineering data becomes available, or as economic and techno-engineering processes change. The prevailing classification system for assessing reserves has been devised by the Society of Petroleum Engineers (SPE) and the World Petroleum Congress (WPC)[47]:

Proven reserves - In general reserves are considered proved if the commercial viability of the reservoir is supported by actual production or rock formation tests. Reserves may also be classified as proved if the logistics for carrying those reserves to market are in, or expected to be in, place. Reserves can also be classified as proven if successful testing of a pilot project on a similar reservoir has taken place and it is reasonably certain that the pilot project will succeed.

Unproven reserves – Unproven reserves are based on the same estimates as proven reserves except that technical, contractual, economic or regulatory uncertainties preclude the reserves being classified as proven. Unproven reserves may be further classified as probable reserves and possible reserves.

[46] For a detailed explanation see www.world-petroleum.org/publications/Petroleum%20Reserves%20Definitions%20doc1.doc
[47] Maugeri, Leonardo, *ibid.*

Probable reserves – Probable reserves are those unproven reserves which analysis of geological and engineering data suggests are likely to not be recoverable.

Possible reserves – Possible reserves are those unproven reserves which analysis or geological and engineering data are less likely to be recoverable than probable reserves.

British Petroleum (BP) is widely quoted as a credible source of global oil reserves. BP estimates that the Gulf and Yemen hold 61.4 percent of the world's oil reserves. For 25 years reserve estimates in the region have increased steadily, for the reasons given above, plus the inevitable 'propaganda' increases proffered by producer states when they feel threatened. The United States Geological Survey (USGS) not only estimates proven reserves but also the potential growth in reserves in known fields and the probable size of undiscovered fields. USGS indicate that the Gulf production could shrink after 2035. This is an important long-term possibility, but one with little practical importance for current midterm energy policies.[48] Oil is a strategic commodity and many Gulf States have used their reserve estimates to stress and enhance their strategic importance and gain outside aid:

- Kuwait's reserves jumped from 65.4 billion barrels in 1982 to around 90.0 billion in 1985.
- Iran claimed a 'propaganda' increase from 58.0 billion barrels in 1982 to 100.0 billion in 1987.
- Abu Dhabi's reserves increased from 58.0 billion barrels to 92.9 billion in the same period.
- Saudi Arabia increased its reserve estimates from 163.4 billion barrels in 1982 to 257.5 billion in 1989.
- Iraq currently lays claim to 78 billion barrels and further claims that it has an additional 100 billion waiting to be discovered in the Western Desert region.

[48] Cordesman, Anthony, *Op cit,* p. 17.

Properties and transport considerations of oil

Crude oils have a number of slightly different characteristics. The discussion will benefit from a brief explanation of the range and properties of these characteristics, particularly when applied to the transportation of crude in oil tankers. The table below lists the different types of crude exported from the Gulf. The 'benchmark' crude's highlighted in bold are those quoted on the market to calculate the average price of oil. 'Light' refers to an oil's density and is expressed for all crude oil grades in degrees API (American Petroleum Institute). Light oils are more valuable and range from 38 degrees to 34 degrees API. Medium oils have an API gravity of about 32 degrees, and heavy oils start at about 29 degrees. As API gravity decreases, the oil thickens until it becomes tar that will not flow at normal temperatures.

Port	Country	Crude	API Gravity
Banias	Iraq	Imeg A	36.10
Banias	Iraq	Imeg B	35.10
Ceyhan	Iraq	Kirkuk	35.10
Das Island	Abu Dhabi	Umm Shaif	37.46
Das Island	Abu Dhabi	Zahum	40.60
Dubai	**Dubai**	**Dubai Export**	**33.50**
Jebel Danna	Abu Dhabi	Murban	40.50
Kharg Island	Iran	Light	33.80
Kharg Island	Iran	Heavy	31.00
Mena Al Ahmadi	Kuwait	Kuwait	31.40
Mena Al Fahal	Oman	Oman Blenn	36.30
Mena Saud	Neutral Zone	Ecoene	16.50
Ras al Khafji	Neutral Zone	Khafji	28.60
Ras Tunura	**Saudi Arabia**	**Light**	**33.40**
Ras Tunura	Saudi Arabia	Medium	30.80
Ras Tunura	Saudi Arabia	Heavy	27.90
Tripoli (Lebanon)	Iraq	Imeg A	36.10
Umm Said	Qatar	Qatar	41.80

Fig 2.3 Table of Gulf Crudes[49]

[49] Akaki, Tony, *The Transportation of Oil by Sea,* iUniverse, New York, 2005, p. 26-27.

The tanker industry operates on very thin margins. Although vessels are available for 'spot' hire, a particular tanker will usually only load a certain range of products for reasons of safety and quality assurance. The climate in the Gulf is ideal for loading, or 'lifting', oil. The average temperature in the region is well above the pour point (the lowest temperature at which oil is observed to flow) of crude's found there. Some tanker owners prefer to specify which type crude they are prepared to load in a bid to reduce corrosion in the cargo tanks caused by sulphur and other metallic properties such as nickel and vanadium suspended in the oil.

Refined products fall into two categories; leaded and unleaded. Products that leave a lead-based residue behind after unloading are classified as being 'dirty'. Tankers carrying unleaded or 'clean' products generally will not load leaded consignments, because the lead deposited in the hold would contaminate any future unleaded cargo. The contract, or 'charter party' between the exporter and importer can be invalidated if the cargo is contaminated, leading to lengthy and expensive insurance claims.

Oil and Modernity

By the turn of the 20th Century oil and its derivatives were being used in an increasing number of highly technical industrial processes. The commercial opportunities open to investors in oil-based technologies and dependent industries heavily contributed towards the success of modernity.[50] Oil encouraged a lifestyle that remains to this day, generally in tune with human desires of affordability, convenience, and independence. Oil became the choice resource of the middle classes, which made it all the more important to democratic governments, as the middle classes held the majority of votes across the population.

By 1900 there were approximately 200 by-products of crude oil in daily use. The versatility of oil was however eclipsed by its use as a fuel for the internal combustion engine. The petrochemical and manufacturing industries followed closely afterwards. Petrol powered the world's first car and aeroplane flight. Plastics on the other hand have undergone a more subtle revolution. Plastic entered the market at roughly the

[50] Other resources such as iron, steel, copper, tin, cobalt and Tungsten also contributed but not as consistently as did oil. Rogers, Paul, *Op cit,* p. 50.

same time as petrol. Plastic or Bakelite as it was then known slowly replaced many wood and metal objects to become the material of choice in the 'throw away' age of disposable utility. Investors realised that commercial success in the transport and manufacturing sectors depended on a guaranteed supply of oil to maintain demand and consumer confidence. Supply however should not be confused with demand. Their characteristics are quite different:

> **Supply is unlike demand. The amount of the oil demanded results from independent choices of millions of households and firms…a few governments make the most important supply decisions.**[51]

The burgeoning infrastructure formed the backdrop to Winston Churchill's often quoted 'Safety and certainty in oil lie in variety and variety alone.' Churchill spoke on the eve of World War I as he switched the Royal Navy's ships from coal to oil fired boilers. He also stated that:

> **If we cannot get oil, we cannot get corn, we cannot get cotton and we cannot get a thousand and one commodities necessary for the preservation of the economic energies of Great Britain.**[52]

US President Calvin Coolidge was to later take Churchill's argument higher:

> **Developing aircraft indicate that our national defence must be supplemented, if not dominated, by aviation. It is even probable that the supremacy of nations may be determined by the possession of available petroleum and its products.**[53]

Churchill and Coolidge both realised that success depended on a reliable and trustworthy oil supply chain. From this point forth inventors gave way to geologists, business chiefs, and politicians who took on the heavy burden of providing industry with a continuous supply of crude. Furthermore, the supply needed to be dynamic as demand for oil was rapidly increasing. Geologists were pulled from obscurity to declare that crude oil was known to be found naturally in the Russian Far East, Central Asia and the Middle East. With the Soviets controlling Russia and Central Asia they

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[51] Claes, Dag Harald, *The Politics of Oil-Producer Cooperation,* Westview, Oxford, 2001, p. 30.
[52] Maugeri, Leonardo, *Op cit,* p. 24.
[53] Maugeri, Leonardo, *ibid,* p. 25.

were off limits to the US. The UK was already producing in Iran so America hedged its future development on striking oil in the remaining Gulf States.

Early oil discoveries in the Middle East

The super-giant oil fields associated with the Gulf were not discovered until after World War II. Oil was first discovered in the Gulf in 1920. It was found in Bahrain on the western side of the Gulf.[54] The first tentative negotiations about prospecting for oil in Saudi Arabia began as early as 1923.[55] The negotiations took place surrounded by the eccentric milieu often associated with British imperialism. Chief negotiator was Major Frank Holmes who secured the first Saudi oil concession after convincing Saudi King Abdul Aziz that there was oil in the Kingdom.[56] Holmes later sold the concession which found its way into the hands of the Standard Oil of California (SOCAL).[57]

The technology required to explore the Gulf had to be imported from the US.[58] Equipment was installed and maintained in a region that had yet to benefit from running water or public telephones. Notwithstanding the technology gap, the Gulf's portfolio increased with strikes in Kuwait's giant Burgan field and further discoveries at Agha Jari in Iraq.[59] The first oil engineers were US or European expatriate (expat) personnel who worked on a temporary basis in the Gulf. They worked in desperate conditions but with few distractions although solidarity among them ran high. The expats shared similar cultures, expectations and adopted English as a common language.[60] They were operating in countries that generally had little or no use for oil themselves, save for Iran. Their hosts took no interest in their craft and appeared passive about the presence of foreigners. Furthermore, the oil industry is not labour intensive. The success of oil companies did not depend on the economic enslavement of generations of indigenous workers carrying out menial tasks. The safety of early ex-patriot oil workers was directed more towards shielding them from the stifling heat and unavoidable boredom that accompanied their work more than anything else.[61]

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[54] Cave Brown, Anthony, *Oil, God and Gold,* Houghton, Boston, 1999, p. 32.
[55] Cave Brown, Anthony, *Ibid*, p. 14.
[56] Cave Brown, Anthony, *Ibid*, p. 14.
[57] Cave Brown, Anthony, *Ibid,* p. 14.
[58] Vitalis, Robert, *America's Kingdom,* Stanford University Press, Standford, 2007, p. 61.
[59] Cave Brown, Anthony, *op cit,* p. 14.
[60] Cave Brown, Anthony, *Ibid,* p. 70.
[61] Cave Brown, Anthony, *Ibid,* p. 70-71.

SOCAL eventually struck oil in the Kingdom's Eastern Province in 1938 and in doing so unwittingly introduced Saudi Arabia to the rentier state, meaning a state "that economically supports society and is the main source of private revenues through government expenditure … supported by revenue accruing from abroad'.[62] This new form of income impacted downwards on the merchant class and their culture of political influence:

> **Oil produced a new kind of economy, built on rents-a rentier economy. Such an economy is heavily reliant on the export of [oil] the production of which requires little contact with the rest of the economy. Most critically for politics, these revenues, rents, are paid directly to the state or, in the gulf, the rulers… [I]t gave rulers direct access to revenues, revenues generated outside the local economy. Where once these revenues had to be squeezed from the population, through the merchants, who in turn exacted a political price, the rulers now received revenues independently.[63]**

Until then the majority of the Kingdom's income had come from fees charged to Muslims on the annual pilgrimage to Mecca. The Global depression in the 1930's had reduced the pilgrimage to a trickle almost tipping the House of Saud towards bankruptcy. The new rentier income however stabilized the economy.

Geologists discovered that oil was concentrated in a sweeping ark around the Gulf coast roughly stretching from Bahrain to the Iran-Iraq border in length, and continuing for about a hundred miles deep inland (see fig 2.4 map of the Gulf oil deposits)

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[62] Luciani, Giacomo, The Oil Rent, the Fiscal Crisis of the State and Democratization in Ghassan Salame, ed. *Democracy without Democrats? The Renewal of Politics in the Muslim World*. London and New York: I.B. Tauris Publishers, 1994, p. 224.
[63] Crystal, Jill, *Oil and politics in the Gulf,* Cambridge University Press, Cambridge, 1995, p. 6.

Fig 2.4 map of the Gulf oil deposits

Exploration everywhere was hampered by the lack of infrastructure in the desert interior, although it was aided by the fact that the oil region in Saudi Arabia is well away from the Holy shrines of Mecca and Medina in the more conservative west of the country. As a result personnel were unlikely to be caught falling foul of Islamic law. What did become noticeable was the high quality of oil extracted from some fields. However, the productive relationship between geology and commerce only comes alive when cost effectiveness is reached. Morris Adelman's blunt explanation of exploration economics condenses economics, cutting edge technology and often fraught politics:

> **The total mineral in the earth is an irrelevant non-binding constraint. If expected finding-development costs exceed the expected net revenues, investment dries up, and the industry disappears. Whatever is left in the ground is unknown, probably unknowable, but surely unimportant: a geological fact of no economic interest.**[64]

SOCAL's investment was tenuous to say the least. The great depression had dropped crude to a lowly $0.10 a barrel. Just as the price of oil was set to fall further

[64] Claes, Dag Harald, *op cit,* p. 21.

simultaneous events in the Gulf and US rescued their investment. In Iraq engineers tapped the huge Kirkuk oil field just as Henry Ford underscored modernity with a car production line. Timothy Amen argues that 'the economics of oil influence the politics of oil and vice versa', and Fords motor car is a good motivator for this cycle.

Suddenly oil became socio-political in that it formed an intrinsic part of the 'American Dream'. The oil industry and automobile manufactures began a highly productive relationship. One US Secretary for Defence stated quite openly that 'What's good for General Motors is good for America.'[65] But the boom did not end with transport. Chemical engineers discovered Nylon, Teflon and Lycra. Polythene followed shortly afterwards. Oil was becoming far more important to society than just fuel for the Navy. Just before World War II broke out SOCAL and Texaco formed the mighty Arabian America Oil Company or ARAMCO.

Just before the outbreak of war US President Roosevelt passed the Shipping Neutrality Act which forbade American Flag ships from trading with belligerents, in particular Roosevelt passed the Act to dissuade Italy from invading Ethiopia. The Act failed in this respect and left Roosevelt in an awkward political position. Roosevelt could not risk repealing the Act so he silently allowed American Flag ship owners to reflag their vessels to fly the Panamanian flag. By 1939 Panama had a total of 52 tankers totalling 700,000 tons on her books.[66] Panama, and soon afterwards Liberia, had become 'Flag of Convenience' (FCO) States in that American owned ships were no longer operating under US regulations but those of the country the vessel is registered to:

> **[B]y far the most important feature of these Flags of Convenience is that essentially all of the Flag State inspection duties were turned over to the Classification Societies [Class]. The Flag State appoints the ship's Class as its agent for inspection. At the same time, the link between a major maritime Flag and a Classification Society was broken. A UK ship was Classed by Lloyds Register (LR). An American Flag ship was Classed by American Bureau of Shipping (ABS). A Norwegian ship was Classed by Det Norske Veritas (DNV). And so on. That was understood. But if your ship is Liberian, which Class do you hire?**

[65] Engdahl, William, *A Century of War,* Pluto Press, London, 2004, p. 111.
[66] Devanney, Jack, *The Tankship Tromedy: The impending disasters in tankers,* CTX Press, Tavernier, 2006, p. 20.

> **The answer is: you shop for the best deal. Now the Classification Societies had to compete with each other for business. If a Class surveyor proved unreasonably inflexible, you complained to his boss; and, if that didn't work, you switched Class.**[67]

Almost immediately it became apparent that American Flagged ships with American crews could not compete in this environment. US labour unions refused to allow non-American crews to sail on American Flagged ships so the US government opted for quiet but strong support of FOC's which were deemed to be under effective US control.

World War II

World War II ground development of the oil fields to a halt. The absence of large scale oil production during World War II was a blessing for the region in that Hitler's main thrust for oil was targeted towards the Caucasus instead. German U-boats made a larger, all be it indirect, impact on Gulf oil. The number of tankers hit by U-boats in the Mediterranean and North Atlantic were so high that few spare tankers were able to lift oil from the Gulf. ARAMCO were worried that falling revenues may tempt the King to revise their concession so its directors turned to Washington for help. In 1942 US President Roosevelt reviewed the Saudi oil concession and declared it crucial to the nation's security, stating that 'the defence of Saudi Arabia is vital to the defence of the United States.' Roosevelt's declaration took into account that on the eve of war Saudi Arabia was producing 60,000 barrels of oil a day and growing (at the end of hostilities this had grown to over 300,000 barrels a day). To signal their deepening commitment to the Kingdom's prosperity and security America made two promises. US President Roosevelt made Saudi Arabia eligible for Lend Lease assistance and ARAMCO drew up plans to construct the Trans-Arabian Pipeline (Tapline) from Dhahran to the Mediterranean. Towards the end of the war Roosevelt and King Abdul Aziz held an historic meeting in Egypt:

> **No records were kept and no American save Roosevelt took part in the discussion…Just how far Roosevelt and the King's discussion of security affairs went we will never know. Most historians and government officials think the two leaders forged a tacit alliance-one which obliged the United States to protect Saudi sovereignty and independence in return**

[67] Devanney, Jack, *Ibid*, p. 20.

for a Saudi pledge to uphold American firms' dominance of the oil fields. Whether or not this was the case, the leaders of both countries have acted as if it were.[68]

The 'special relationship' between the US and Saudi Arabia had begun. Peace brought with it a new set of challenges. A major re-evaluation of global military strategies and priorities relied on oil to be effective. Oil was needed to fuel huge motorised divisions, power heavy bombers and feed the military-industrial complex that fought the Cold War.

During the war the British government developed the 'Worldscale Index' for paying the owners of requisitioned tankers. After the war the tanker industry adopted the system which has been progressively revised over the years, the last amendment being in January 1989 when 'New Worldscale' was introduced:

The Worldscale index is published in a book which is used as the basis for calculating tanker…rates. The book shows, for each tanker route, the cost of transporting a metric tonne of cargo using the standard vessel on a round voyage. This cost is known as 'Worldscale 100'. Each year the Worldscale Panel meet in London to update the book…The Worldscale system makes it easier for ship owners and charterers to compare the earnings of their vessels on different routes.[69]

For example to calculate a journey from Jubail in the Gulf to Rotterdam at Worldscale 50 in 1997:[70]

Worldscale 100 from Jubail to Rotterdam = $17.30 per metric tonne
Worldscale 50 (half of Worldscale 100) = $8.65 per metric tonne
Vessel capacity 250,000 metric tonnes
Revenue: 250,000 multiplied by $8.65 =$2,162,500

It is also important to note that rates are quoted and usually paid in dollars, as are the crew's wages, bunkering (fuel) costs and port charges making the dollar the (un)official currency of the tanker industry.

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[68] Klare, Michael, *Blood and Oil,* Penguin, London, 2004, p. 36.
[69] Stopford, Martin, *Maritime Economics,* Routledge, London, 2007, p. 93.
[70] Stopford, Martin, *Ibid*, p. 93.

In 1948 the International Maritime Organization (IMO) was formed. The IMO is part of the United Nations (UN). It is important to note that the IMO has no legal, regulatory or inspection powers. A member country is a member of the IMO by virtue of the ships that are registered under its Flag. Voting is based on the size of each country's fleet. Currently this means that the FOC Marshall Islands Flag has three times the voting power of the US. IMO regulations are only effective if they are adopted and enforced by a 'Port State' (the Port State is the country where a ship loads or discharges). If one or two major Port States enforce an IMO regulation then tanker owners must comply or lose business.[71]

Post-war Gulf until 1951

Post World War II geopolitics affirmed the creation of Israel. By fault rather than design the creation of Israel was not hamstrung by the question of Arab oil. Israel's existence put several pipelines running from Iraq to Haifa out of action but as far as oil went, that was about all. Elsewhere the Gulf pipeline network was beginning to take shape. As mentioned earlier the regions oil deposits are located close to the Gulf coast. With scant internal infrastructure to service, the pipelines generally flow outward to export. In the main they were constructed along the most economical 'as the crow flies' route. The Tapline is no exception. It was eventually built in an almost straight line between Abqaiq in Saudi Arabia and Sidon in Lebanon, to an export terminal on the Mediterranean Coast.

It should also be noted that scant attention is played to the amount of American personnel employed in the KSA. There is little if any analysis of their role and importance in international relations or international security literature. Only in books written by ex-pats is any insight available – yet US oil field personnel play a key role in servicing the supply chain. Questions such as are they easy to replace? Are young engineers entering into the industry? And, are there any challengers to the *status quo* such as Europe or China (as discussed later in Chapter 6)? The assumption appears to be that not only are US personnel adjunct to KSA, but their presence as an insurance against any possible disruptions was overlooked and not mentioned. This

[71] Devanney, Jack, *Ibid*, p. 27.

may all seem irrelevant, but the position of American personnel employed on huge projects[72] was not a reported factor during the cooling of relations and air of suspicion between Washington and the KSA after 9/11.

The US has predominantly supplied parts and equipment for the KSA oil fields with European manufacturers in second place. Saudi itself supplies a small inventory of parts, as the Kingdom has not invested in its own heavy industry manufacturing sector. Above all else the quality of the parts has maintained the constant running of the oil supply chain. American manufacturers are unlikely to lose control of the service and maintenance of the KSA supply chain. The knowledge transfer alone would be a formidable task for a new provider, and huge American companies such as Halliburton and Bechtel are among the few private companies which possess the resources to bid and deliver for oil infrastructure contracts tended by the KSA.

One area that American service providers have found problematic is the rise in counterfeit parts which have entered the market since China's economic rise to prominence. This aspect will be discussed later in the thesis in Chapter 6, but again, considering that 'security of supply' has increased the previous remit of government to government deals to now incorporate the security of the physical supply infrastructure, the influence and impact of China on the physical infrastructure is as yet unreported among IR and Security Studies commentators.

In 1949 the US became a net importer of oil. Fortunately the tilt was accompanied by a number of hugely successful wells sunk by ARAMCO. Engineers discovered Ghawar, the largest onshore oil field in the world. The size of ARAMCO's operation in the Gulf grew accordingly, and suffice to say that the profuse super-giant Ghawar and its copious neighbour Abqaiq supplied enough crude for the American, European and Far Eastern markets. Unfortunately the post-war period was to be the last time the Gulf producers provided the developed world with a reliable free flowing supply of oil. Disruptions were soon to become commonplace (see Fig 2.5).

[72] Even towards the end of the life of this thesis the Halliburton announced that 'Halliburton was awarded five-year oilfield service contract by Saudi Aramco in November 2009 to develop up to 185 oil production, water injection and evaluation wells at the world's biggest oil field.' Contracts of this size cannot be dropped and taken up by a different service provider without overcoming tremendous difficulties. http://www.hydrocarbons-technology.com/projects/ghawar-oil-field/

Date of oil supply disruption	Duration of supply disruption (in months)	Average gross supply shortfall (in MMBD)	Reason for oil supply disruption
3/51-10/54	44	0.7	Iranian oil fields nationalized
11/56-3/57	4	2	Suez War
12/66-3/67	3	0.7	Syrian transit tax dispute
6/67-8/67	2	2	Six Day War
5/70-1/71	9	0.8	Damage to Tapline
3/73-5/73	2	0.5	Unrest in Lebanon, damage to transit facilities
10/73-3/74	6	2.6	October Arab-Israeli War; Arab oil embargo
4/76-5/76	2	0.3	Lebanese Civil War, disruption to Iraqi exports
5/77-	1	0.7	Damage to Saudi oil fields
11/78-4/79	6	3..5	Iranian revolution
10/80-12/89	3	3..3	Iran-Iraq War
03/90-10/91	7	1	Kuwait oil well fires
09/11/01	-	-	World Trade Centre attacked
3/03-9/04	19	1	Iraq war and continued unrest

Fig 2.5 Global oil supply disruptions: 1951-2004[73]

Iranian oil fields nationalized

The background to Anglo-Iranian oil industry is steeped in colonial tradition. The atmosphere prior to nationalization saw domestic Iranian employees suffering dire working and social conditions. Their British masters took the view that the oil industry would not have been built had it been left to the Persian government or people. In

[73] Cordesman, Anthony, *Op cit,* p. 105.

1951 Iranian Prime Minister Mohammad Mossadegh incurred the British wrath when he nationalized the Iranian oil industry. Mossadegh was eventually placed under arrest after a coup. Britain's response was double standards as the British government had just nationalized its own coal, electricity, railways, transport and steel industries. The incident produced a total shortfall of 924 million barrels spread over three and a half years. There is no evidence to suggest that it was the disruption's effect on the economy that brought about Mossadegh's removal, but rather the inconvenience he caused. The situation was easily ameliorated by bringing a willing Shah to office. The coup has been cited as the root of the 1979 Iranian revolution.

1956 Suez Crisis

The 'Suez Crisis' began when the US officially informed President Nasser of Egypt that they would not finance his ambitious Aswan Dam project. Nasser retaliated a few days later by announcing the nationalization of the Suez Canal with a view to using the tolls to fund the project instead. To the detriment of the international community Nasser chose to freeze traffic in the Red Sea and Gulf of Aqaba, thereby effectively cutting off a significant amount of Gulf exported oil. Europeans, having almost no oil of their own were asked to only make essential journeys, railways switched from diesel back to steam locomotives, holiday resorts lay deserted and the spectre of rationing loomed high. The British in particular feared a return to life similar to that lived during the war years.

The Canal was also an important source of income for Britain and France. As owners of the Canal Company they stood not only to lose out financially, but hand over the geopolitical importance of the canal to Nasser. Britain, France and Israel decided to take the Canal back by force but the operation failed when the US refused to support the plan. To the delight of the Egyptians the Anglo-French coalition found no other supporters among the international community for their intended act. Moreover, the crisis competed for international attention along with the shock Soviet invasion of Hungary.[74]

[74] It could also be argued that Suez marked the beginning of the end for Colonial rule.

The US decision not to get involved in either Suez or Hungary is the subject of vigorous historical debate, but the manner by which America dealt with the two events did indirectly impact on oil industry investment. On the one hand the US had just finished the Korean War against its nemesis, communism, and wished to avoid a further ideological war over Hungary. On the other hand the US was, at the time, behind in the arms race. The Soviets were clearly ahead. Soviet scientists had successfully tested a deliverable hydrogen bomb,[75] and given Hungary's geographical location, Moscow was well placed to use the bomb in anger during any intended invasion by US troops. Other considerations to take into account were the sudden rise, after the passing of the GI Bill[76], of the US civil rights movement. In turn the civil rights movement rose, alongside ordinary Americans increasing awareness of America's place in the world following World War II and impact of the Marshall Plan. The possibility of a revolt by black Americans over the draft, combined with the rise of post-war liberalism among America's middle classes may well have tipped the balance away from US participation in either Suez and/or Hungary.

Regardless of the debate, by fault or design the outcome further strengthened US hegemony, although the full economic benefits would be felt much later. The benefits abroad lay in the US eventually befriending and empowering Egypt (with Israel in mind). Egypt was the Middle East's first Arab quasi-democracy. Washington was influential in choosing Egypt's leadership that were shored up with US backed interests. At home US segregation laws were overturned allowing millions of black Americans to compete for jobs, deposit savings and apply for credit to buy homes and cars. All of which were possible by maintaining healthy industrial investment in US commercial interests, including the oil industry, both at home and abroad. Among the benefactors to make new investments as a result of the Suez crisis were the tanker owners. They invested heavily in new bigger vessels:

[75] The Soviet deliverable device was built by a team of scientists based at Arzimas-16 led by Igor Kurchatov and Andrei Shakharov. Mathematician Vitaly Ginzburg proposed using Lithium 6 to induce a thermonuclear explosion. The device was dropped from a plane over the Semipalatinsk-21nuclear test site on November 22nd 1955 and detonated successfully yielded 1.6 Megatons (1.6 million tons of TNT). The US had tested similar devices in the South Pacific but they were undeliverable installations weighing up to 250 tons each.

[76] The G.I. Bill (officially titled Servicemen's Readjustment Act of 1944, PL345) provided for college or vocational education for returning World War II veterans (commonly referred to as GIs or G.I.s) as well as one year of unemployment compensation. It also provided loans for returning veterans to buy homes and start businesses.

> **It was during the 1956 Suez crisis that [tanker] owners made their biggest killings. When the canal was closed and tankers had to be rerouted round the Cape of Good Hope there was not enough available to carry the oil that was needed, and charter rates rose astronomically. The companies, believing like everybody else that the Egyptians would be incapable of running the canal after it had been cleared, thought the shortage would last well into the 1960's until new ships had been built. They therefore signed contracts in which they not only hired tankers for immediate work at the high prevailing rate but also agreed terms for chartering ships which had not yet been built for work in the 1960's…When the Egyptians showed they could operate the canal efficiently the bottom fell out of the tanker market, but the companies were stuck with the contracts.**[77]

The immediate losers in terms of aggravation and economic loss were the major importers, especially the neutral US. The markets reflected the overall uncertainty prompted by the canal's closure. In New York shares dipped on the Dow-Jones except for in the steel industry. Manufacturers of steel plate used in shipbuilding saw their shares jump to record highs. The circumstances surrounding the sudden activity in the steel plate market serve as a clear example of the incongruity that oil posed to major importers.

The rise of steel plate was twofold. Firstly, US shipbuilders were signing new deals, struck on the back of the detour the Suez Canal's closure was expected to cause. Shipbuilders began to receive orders for bigger 'Cape size' tankers which grew into Very Large Crude Carriers (VLCC) or more colloquially 'Supertankers' by the late 1960's. The decision to build larger tankers was business minded. Tankers routed via the Cape of Good Hope took longer to reach the west and therefore made less voyages per year. To make up for the shortfall in cargo oil ship owners ordered larger tankers to remain competitive, but there was not enough steel stock to meet demand. Shipbuilders had new vessels requiring up to 60,000 tons of steel each, almost twice the usual size, in their order books.

Secondly, the downside was that steel requires a great deal of energy, including oil, to manufacture. Oil was scarce in the developed world because of the drop in supply from the Gulf, but nevertheless demand for oil in the production of steel was rising. Another abrasive factor to consider is that the situation was a unique consequence of

[77] Stopford, Martin, *Op cit*, p. 61.

the Suez closure. It could be said that the situation was artificially created and could therefore not have been foreseen, as opposed to a situation where demand for steel plate grew along with the slower paced natural development of oil tankers. The bottom line for the US was that the sudden increase in steel plate production (and oil needed in the manufacturing process) was down solely to the drop in supply caused by the canal's closure, and as such the way out of the Suez crisis marked the start of an uncertain self-perpetuating cycle, aptly described later by Robert Putnam as a mechanism for generating even bigger quandaries:

> **Domestic politics and international relations are often somehow entangled, but our theories have not yet sorted out the puzzling tangle. It is fruitless to debate whether domestic politics really determine international relations, or the reverse. The answer to that question is clearly 'both sometimes'.**[78]

Paul Wolfowitz later remarked on US-Gulf policy:

> **[T]here is a circle that describes how American capability in the Gulf depends on cooperation from Gulf countries. That cooperation depends on their estimate of our capability, and you end up with a circle-which can be a virtuous circle, when things are going well, or a vicious circle when things are going badly.**[79]

Putnam's theory and Wolfowitz's practice are evident in the US response to the crisis. The US countered by increasing its domestic oil production to supply the steel industry and also supply allied Europe with oil as well. As a result US supply became overstretched and looked set to further deplete US reserves. To relieve the pressure on its domestic supply the US invested long term in prospecting for oil abroad. The underlying risk was that these new sources could leave America further aligned to similar repercussions, or worse, from future disruptions caused by the new suppliers, countries that tended to be diametrically opposed the western values of democracy, capitalism and freedom of speech.

Suez fired a shot across the bows of major consumer states but the reaction from the oil industry, despite the inconvenience to the public, was muted. Oil prices edged up

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[78] Clas, Dag Harald, *op cit,* p. 17.
[79] Bloomfield jr, Lincoln P, et al, *Global Markets and National Interests,* CSIS, Washington DC, 2006, p. 191.

and tanker rates climbed 38% to a record high of 150% above the previous year. The rates did not hold up when the canal surprisingly reopened. Tanker operators were suddenly plunged into a recession. The disruption cost 240,000,000 barrels of oil over four months, a proportion of which was not 'lost' as such but only late arriving after being re-routed via the Cape. If viewed stoically the Suez crisis was the first of a number of incidents overcome by conforming to the problems the disruption created, and developing the oil industry accordingly. In this case it was the mid-stream tanker industry that compromised and adapted.

The major producers rallied. In 1960 they formed the Organization of Petroleum Exporting Countries (OPEC). Gulf producers dominated OPEC. For the sake of this thesis the author acknowledges that OPEC has played a major role in setting quotas. However, the author takes the view that OPEC is a regulatory body and as such can be argued as 'disruptive' but not in itself a 'disruption'.

1966-1967 Syrian Transit Tax Dispute

The Syrian transit tax dispute marked the first of a number of similar disputes that eventually led to the demise of the Middle East's inter-state pipeline network. The dispute resembles a multi-facetted brawl. The dispute affirms the important role that mid-stream logistics often play in sustaining market stability, but conversely it underlines the role economic factors, such as transit taxes as opposed to political action, play in creating disruptions. Further analysis of the dispute reveals the flinty pre-nationalization public/private sector relationship evident in Iraq before the oil industry was nationalized in 1972. The philosophical output of the dispute is more ominous. It draws attention to Iraq's isolated position among its neighbours for allowing a domestic argument to become an international issue. The dispute serves as a lesson in reason. It warns exporting government against sealing their own fate (and oil supply) by pushing fiscal sine qua non to the point where oil companies curtail exports in sympathy against payment.

Abd al Karim Qasim brought Iraq to revolution in 1958. The pro-western monarchy was overthrown and replaced by a Republic. Prior to the revolution Iraq's British owned oil industry, the Iraqi Petroleum Company (IPC) enjoyed cordial relations with

the government. Their post revolution position was less blinkered. The prevailing mood among the general public was that the IPC was a drain on their resources. In order to appease the people, Qasim exerted his authority to great effect and at little cost, by raising the transit tax from the Basra oilfields in the south to the export terminals in the Gulf. The IPC retorted by cutting back on Basra exports and increasing production at Mosul for export via Syria to a number of Mediterranean export terminals. The situation held until December 1966 when the Syrian government exploited the situation and fell into dispute with the IPC over transit taxes:

> **Syria demanded an increase of IPC's royalty payments in addition to retroactive payment [s]…the Syrian government claimed it was due…When the IPC balked at these demands, the Syrian government on 8 December impounded all IPC property in its territory, including 300 miles of pipeline, several pumping stations, and the terminals at Banias. Syria banned the loading of tankers with IPC oil. When the IPC's storage tanks filled on 12 December, the oil from Iraq stopped flowing.** [80]

By then Iraq was exporting 60% of its oil via the Mediterranean. The sudden loss and seeming lack of a quick remedy was decisive. The market reacted accordingly and the price of crude went up. The IPC and Iraqi government were therefore dealt a double blow. First, the IPC could not capitalise on the higher price because their exports were vastly reduced. Second, a 60% cut in production equated to losses in revenue for both parties. Gulf exporters detached from Iraq's predicament were unsympathetic. Iraq's neighbours quickly gained the trust of importers by increasing production to make up for the shortfall. The dispute had unwittingly made the inexperienced Iraqi government a victim of its own success. In order to compensate for fiscal (transit tax) losses the government ordered the IPC to settle with Syria and resume production. The IPC countered, to the government's chagrin, by ignoring the threats. Instead the IPC entered into an agreement with Syria, on its own terms, thus bringing the dispute to an audacious end.

Michael Brown finds evidence of a further twist. He theorises that the IPC could well have used the dispute to gain access to the government owned Rumaila oilfield in the south of Iraq. Brown posits that the Iraqi government claimed at the time that the

[80] Brown, Michael E, *The nationalization of the Iraqi Petroleum Company,* International Journal of Middle East Studies, Vol 10, No. 1. (Feb., 1979), p. 116

dispute was artificial and the IPC were being unnecessarily stubborn in its negotiations with Syria. The assumption being that the resultant pressure from loss of revenue would force the government to hand over the Rumaila oilfield for development. Brown concludes that it is quite possible that the IPC utilized the opportunity to pressurize the Iraqi government over the issue, but with little effect as in the end Rumaila was not handed over to the IPC. The dispute lasted for twelve weeks and cost 63,000,000 barrels in lost production. But the real damage lay in strained inter-state relations. Besides further disengagement between the IPC and Iraqi government the dispute drew attention to a greater ill. The whole affair cast serious doubt on states offering their land to exporters in return for the exposure to the chicanery now associated with transit taxes and pipeline politics in general.

1967 Six Day War

The Six Day War redrew the Gulf export map. The synchronised surprise attack by Egyptian, Syrian and Jordanian forces on Israel has been the cause of resentment ever since. Israel took a mere six days to repel the attack during which the Israeli's took ground from all three warring parties. The war did not damage the regions oil infrastructure but it did make a lasting difference to mid-stream logistics.

Before war was declared the Arab nations were unusually united. They were all adamant in causing a disruption so big that it would deter importers from supporting Israel during the war. Collectively they initiated the first Arab oil embargo:

> **Right after the outbreak of the Six Day War the representatives of the oil producing and transporting countries met on June 4-5 and decided to stop the flow of oil to the world markets and prevent Arab oil from reaching directly or indirectly any country which supported or was obligated to support Israel. On June 6, Syria announced that she had closed all the pipelines from Iraq and Saudi Arabia which crossed her territory. On the same day Lebanon announced that she had banned the loading of…tankers at the terminals in her territory. On the following day Saudi Arabia announced that she had banned the loading of tankers bound for countries which supported Israel, and prohibited export of oil.**[81]

[81] Shwadran, Benjamin, *Middle East Oil,* Schenkman Publishing Co, Cambridge (Mass), 1977, p. 7.

Less than a week later the situation was vastly different. In view of the Arab defeat Kuwait, Libya and Iraq reversed the decision and resumed exports. Saudi Arabia also began loading tankers except those destined to the US and Great Britain but this arrangement only lasted until the end of June. The geopolitical outcome of the war impacted on Suez again. It was closed once more but this time the tanker industry was prepared:

> **So many ships were ordered in the aftermath of the 1956 crisis that for several years before the canal closed again in 1967 there was a considerable surplus of tankers, and many of them had to be converted to grain carriers to find employment. As a result the ship owners were unable to repeat their coup. Within a few weeks of the closure some 200 tankers totalling 5m tons had been brought back into oil carrying, and Europe's supplies were assured. The companies therefore refused to charter vessels for more than two or three voyages at a time, instead of for several years ahead. Nevertheless, the crisis was highly profitable for owners…**[82]

The mid-stream proved itself to be highly adaptable again. A further development arose when oil companies decided to hand over their shipping business to independent owners. The reason behind the move came from the oil industries reaction to the fear of maintaining supply during the Suez Crisis. Oil companies decided to develop new fields in Africa, Alaska and the North Sea. However, exports from these new fields were smaller and spread about the globe. This caused logistical problems for the oil companies that had traditionally lifted oil from the Gulf. Faced with the prospect of incorporating such a change into their operational budgets companies chose to sell their fleets to smaller operators.

The Tapline also became a victim of the Six Day War when Israel occupied twenty-five miles of the pipeline's route over the Golan Heights:

> **The…war…created enormous new problems for ARAMCO. When Israelis seized Syria's Golan Heights on 9 June…The Saudis retaliated by shutting down ARAMCO's operations at Dhahran, but within days the firm persuaded its old friend King Faisal to reverse himself. Saudi crude continued to flow through the Israeli-occupied no-mans-land without incident until 30 May 1969, when Popular Front for the Liberation of Palestine**

[82] Stopford, Martin, *op cit,* p. 62.

> **(PFPL) commandoes…dynamited Tapline, spewing hundreds of tons of oil into the Sea of Galilee.** [83]

Israel ordered ARAMCO to pay for the clean-up operation before allowing pumping to resume. Later in 1969 the PFPL fired rockets into Tapline's Sidon terminal causing yet more damage and mayhem.

During this period Saudi Arabia discovered its last great oilfield. In 1969 geologists found the massive Shaybah complex, 400km into the Kingdom's Empty Quarter. Since then no other field the size of Shaybah has been discovered in the Kingdom. A further tremor of unease can be detected in that the field did not come online for another thirty years due to the huge start-up costs.[84]

In 1969 tanker owners faced an unanticipated but critical problem. In the space of three weeks in December 1969 three new Supertankers[85] had massive cargo tank explosions while they were in the process of tank cleaning. Shell instituted a crash research programme:

> **[T]he conclusion [was that] the high speed jets of water impinging of the steel surface of the tank were creating static electricity, in somewhat the same way that rain drops in a thunderstorm do. When enough static electricity builds up, it produces a spark that is full of hydrocarbon vapour. The process is tank sized dependent and didn't really make itself obvious until tanks grew to VLCC [Supertanker] size.** [86]

From this point forth tanker operators 'inerted' the cargo tanks by pumping exhaust gas into the vessels tanks. Inerting was to save countless lives but the onus was on the owners and operators to conform. In 1979 fifty French merchant seamen were killed after their ship, the *Betelgeuse,* exploded due to a mixture of corrosion and un-inerted tanks while discharging at Bantry Bay in Ireland. The deaths and

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[83] Little, Douglas, *Pipeline Politics: America, TAPLINE, and the Arabs,* The Business History Review, Vol. 64, No. 2, American Business Abroad. (Summer, 1990), p. 283.

[84] The logistics and economics involved in supplying building materials to the field were quite astonishing. Pipes to construct Shaybah's gathering system were trucked from England. After offloading the pipes truck owners found it more cost effective to sell the truck and trailer in Qatar, then fly back to the UK, purchase another rig with cash from the earlier sale and repeat the journey against the traditional alternative of driving the truck home overland and suffering border delays in Eastern Europe.

[85] The *Marpessa,* The *Mactra* and the *Kong Harkon VII.*

[86] Devanney, Jack, *Ibid*, p. 29.

the complete destruction of Total Oil's Bantry Bay terminal did not move the Irish government to pass any more safety laws other than were already in place at the time. Salvage experts took two years to remove the hull from the scene. To this day Classification Society inspectors can issue a certificate of seaworthiness without inspecting a vessels cargo tanks.

1970-1971 Damage to Tapline

In May 1970 a Syrian bulldozer damaged the Tapline at Derra on the Syrian-Jordanian border during repairs to telephone cables. The damage appeared to be light and the consensus was that it would take about 24 hours to fix. The Syrian government saw political opportunity escalating out of the crisis and refused to allow work to begin. Tanker rates tripled overnight when Tapline dried up as there were no vessels in place to lift oil diverted from Tapline at Saudi's Ras Tunura terminal. It took almost a year of negotiations before Syria finally sanctioned the repairs. During this time Syria had seen a change of government but the financial demands on Tapline remained. The final deal included a doubling of the current transit fee and $9 million to cover other claims. Paul Stevens offers further insight to Syria's motivation to block Tapline exports:

> **Libya was in dispute with its oil companies over posted prices. As part of this process the Libyan government had constrained production resulting in rising price of Mediterranean crude. The closure of Tapline aggravated the tendency thereby making it more attractive for the companies to accede to Libyan demands which they eventually did. In 1971, Libya made a substantial aid payment to Syria.**[87]

Lebanon was also unhappy about Syria's stance. The closure had deprived Beirut of transit taxes and crude for Sidon's Medreco Refinery. Saudi Arabia stirred the disquiet with rumours that they were considering closing Tapline. The disruption cost 216,000,000 barrels of oil and re-enforced earlier fears regarding the dangers in topping up trust from the economic drain of interstate pipelines. A year later Tapline was embedded in another quarrel, this time with Jordan. In what was to be a unique

[87] Stevens, Paul, *A History of Transit Pipelines in the Middle East: Lessons for the Future,* CPMLP, Dundee, 1996, p. 7.

show of teamwork, the line remained open during the dispute as both sides had decided to suspend payments to each other until they settled their differences.

By the mid 1960's it was apparent that the US economy was struggling to compete against the growing economic strength of Western Europe, and also stem the soaring US public deficits as President Johnson escalated the war in Vietnam. Uncertainty over the Vietnam War led to many European countries, starting with France, to redeem their dollars for gold. By the summer of 1971 the US Federal Reserve's gold stocks had become critical. On August 11th 1971 the Nixon administration opted to abandon the dollar-gold link entirely, thereby going to a system of floating currencies. At the same time OPEC began discussing the viability of pricing oil trades in several different currencies under the watchful eye of the governor of the Saudi Arabian Monetary Authority (SAMA).

The Nixon administration was keen to prevent this monetary transition to a basket of currencies. Washington entered into high level talks with Riyadh, requesting them to unilaterally price international oil sales in dollars only. The US made assurances to its European and Japanese allies that such a unique monetary/geopolitical arrangement would not transpire, but regardless the Saudi government met America's request and began posting all their oil sales in dollars, thereby effectively re-branding the dollar away from gold and substituting (their) oil instead. [88]

1973 Unrest in Lebanon

In April 1973 terrorists blew up a storage tank at Sidon, Lebanon. They managed to damage a further three tanks before fleeing. A couple of days later terrorists attempted to blow up Tapline but succeeded in only denting the pipe. The disruptions cost 30,000,000 barrels of oil and left the future of Tapline hanging by a thread.

[88] Clark, William R, *Petrodollar Warfare: Oil, Iraq and the future of the dollar,* New Society Publishers, Canada, 2005, p. 19-20.

1973-1974 Arab-Israeli (Yom Kippur) War and oil embargo

The 1973 Arab-Israeli War and subsequent second Arab oil embargo proved to be a seminal event for Gulf producers. Western support for Israel during the war led to Gulf exporters upholding an OPEC embargo on the US and Dutch exports. A great deal has been written about the political and economic effects of the embargo but in-depth analysis would be out of place here. John Mitchell's observations capture the mood well. He points out that one of the less politically endearing qualities of the embargo were newsreel pictures of motorists sitting in lines waiting to fill their tanks with petrol. Adelman is less dramatic arguing instead that the oil supply was in fact unaffected by the embargo 'It was not loss of supply, but fear of possible loss that drove up prices.' During the embargo the oil market reacted to what is now referred to as the 'fear factor', whereby it reacts to the embellished content of the threat and ups the price of oil accordingly. In the case of the embargo the fear factor was the grey area in which the fear of a disruption taking place was treated as if it had done so to its worst case scenario. It should also be noted that the markets relied on antediluvian communication technology and were not yet globally linked. During the embargo market sensitive information arrived in the form of telex and telegram transmissions, initially received in England by the General Post Office at the 'Radio Portishead' Long Wave Station near Bristol. A situation no doubt seen as wholly unsatisfactory in today's climate.

Saudi Arabia, the original protagonist called off the embargo for seemingly geopolitical reasons. The Kingdom stood to break its relations with the US over the issue, a fate that would have left Riyadh exposed to its more radical neighbours still high on 'embargo bravado'. The embargo caused a great deal of tension between producers and their customers, to the extent that producers began to nationalize their respective oil industries. Certain exporters however were not so keen and disagreed with nationalization on objective grounds:

> **In spite of the general agitation in the Arab world, or perhaps because of it, for nationalization of the oil industry, the Saudi Arabian Oil Minister Yamani, stated at the end of April 1973, that since the industrial world depended on oil, Saudi Arabia was ready to do everything in her power to guarantee the flow of oil to its destinations. He stated that**

the producers must not nationalize their oil, for they were not qualified to wrestle with the two most crucial aspects of the industry: exploration and marketing.[89]

Saudi Arabia eventually nationalized its oil industry but, along with most other exporters, they upheld Yamani's strategy regarding leaving the upstream and downstream sectors in the traditional hands of expat workers and international oil companies respectively. The nationalized oil industries were left with the mid-stream infrastructure and management of human resources, consisting of pipeline gathering systems, pumping stations, export terminals, refineries, office blocks and staff compounds.

The net result of the embargo and the subsequent December OPEC meeting was damning. The Organization pushed the price of crude up by a staggering 400%. Benjamin Shwadran dampens any elation by concluding:

An analytical examination of the outcome of the attempt would reveal that the embargo was a failure-its political goals were not realized-except for one real achievement: tremendously large increases in the posted prices of oil…the size of the increases alarmed Saudi Arabia, the leader of the embargo movement; the Saudis feared that in the end the increases might defeat the purpose of the undertaking.[90]

The embargo is often referred to as an example of oil being used as a weapon, when in reality the antagonists ended up falling on their sword. It was a bitter paradox for OPEC in that the embargo had the effect of increasing the supply of non-OPEC oil to OPEC customers. The mechanism for which is described here by Matthew Simmons:

At the time, Saudi Arabia's cost to produce its oil was extremely low since all of the producing fields had been discovered and developed 10 to 30 years earlier. But by 1973, the real cost to create a new oilfield in Saudi Arabia had already grown to far more than an incidental expense. Moreover, it had suddenly become rather difficult to find great new oilfields…At $2 or $3 per barrel [post-embargo] oil was so cheap that no one had any reason not to use it to its fullest. Demand was quickly outstripping supply, putting constraints on consumption. This is why the price of oil never came back to the $2-to-$3 range that many oil observers considered normal and expected to see again…the Alaskan

[89] Shwadran, Benjamin, *Op cit,* p. 64.
[90] Shwadran, Benjamin, *Ibid,* p. 83.

> **Pipeline and most of the North Sea's first generation of giant oilfields were already being planned or were under construction when oil prices exploded…Had oil prices remained low, the cost overruns that these massive projects incurred would have brought their owners to their economic knees. Many extremely expensive new energy projects became rational and commercially viable only because oil prices soared so high.**[91]

Later disruptions were to follow a similar pattern. Prior to the embargo the tanker industry was enjoying a boom due to a rise in demand. Owners were therefore prepared to pay a premium to introduce new vessels to their fleet. Tankers ordered for $11 million in 1970-71 were changing hands for between $25-30 million on the eve of the war. The post embargo situation found owners in severe debt after buying vessels at these inflated prices. Not surprisingly the drop in demand caused by the rise in oil prices placed the tanker industry in a depression. Falling tanker rates also affected the Tapline. Post embargo rates were low enough for importers to lift directly from the Gulf rather than pay Tapline's erratic transit taxes and load from the Mediterranean. Tankers began making Gulf cycles but when Tapline eventually reopened again rates increased because importers chose to break the Gulf cycle and charter tankers to lift oil from Sidon again.

The embargo was also partly tempered by emergency stockpiles held after previous lessons learned by importers to carry them over disruptions. The embargo caused a shortfall of 468,000,000 barrels of oil over six months. Regardless of the loss and resulting high prices US oil consumption rebounded by 1974, to eventually peak at a record breaking 18.5 million barrels per day (most of which was domestic) in 1978. The effect of high oil prices on the tanker industry were nothing short of devastating. The price of a newly built VLCC fell from $52 million in 1973 to $5 million by mid-1977. Many owners laid up their vessels and those left in the market could barely command a rate large enough to cover the cost of the voyage.

[91] Simmons, Matthew, *Op cit*, p. 56-58.

Post-embargo petrodollar recycling

It was the post-embargo high oil price, as opposed to a shortage of oil that motivated the world's top financiers and policy makers into action. Initially the dollar/oil partnership caused a great deal of inflation in the US, which came to an end soon after the US and UK (London being the world's financial centre) began the craft of 'petrodollar recycling'[92] following the 1973 oil embargo. In May 1973 a select group of internationally well respected governors and regulators of the world economy met in Sweden to develop a plan by which their representative countries would gain from the current high price of oil.[93] Six months later President Nixon was embroiled in the Watergate affair leaving Henry Kissinger as America's de facto President:

> **In 1974 an agreement was reached with New York and London banking interests that established what became known as 'petrodollar recycling'. That year the Saudi government secretly purchased $2.5 billion in US Treasury Bills with their oil surplus funds, and a few years later Treasury Secretary Blumenthal cut a secret deal with the Saudi's to ensure that OPEC would continue to price oil in dollars only.[94]**

Washington installed an investment banker, David Mulford,[95] as director of the Saudi Arabian Monetary Agency (SAMA), the central bank of Saudi Arabia. Mulford was well placed to give investment advice to the Saudi authorities. To ease the process, New York based Citibank (with close ties to ARAMCO) were able to operate in the Kingdom, the only wholly privately owned bank ever to do so. In 1974 Saudi Arabia invested $57 billion directly into US and UK financial institutions:

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[92]Petrodollar recycling refers to the phenomenon of major oil-producing states mainly from OPEC earning more money from the export of oil than they could usefully invest in their own economies. It was a phenomenon of the late 1970s and early 1980s with the peak years for petrodollar surpluses.

[93] Research on the issue of petrodollar recycling has exposed the author to a number of conspiracy theories which rely on the 1973 embargo being a planned event orchestrated by the US and UK, William Engdahl states that 'Contrary to popular impression, the Yom Kippur War was not the simple result of miscalculation, blunder or an Arab decision [to invade Israel]…The entire constellation of events…was secretly orchestrated by Washington and London…using Henry Kissinger…Kissinger cultivated channels to the Egyptian and Syrian side. His method was to misrepresent to each party the critical elements of the other, ensuring the war and its subsequent Arab oil embargo' in Engdahl, William, *A Century of War: Anglo-American Oil Politics and the New World Order,* Pluto Press, London, 2004, p. 135-136. For this reason the author has only referred to reliable referenced facts in Engdahl's book. The author rejects the idea of a staged embargo for a number of reasons including; 1) Washington and Tel-Aviv were unlikely to sanction the invasion of Israel so that the US could arm Saudi Arabia; 2) With or without the embargo Saudi Arabia had nowhere else to deposit or spend its oil revenue than in the US or Europe. The conspiracy theories also offer highly detailed accounts of secret Bilderberg Group meetings. The author is in no doubt that these meetings took place but remains unconvinced that the participants were in fact plotting, as some would have you believe, to secretly rule the world.

[94] Clark, William R, *Op cit*, p. 20.

[95] David Mulford is the current US Ambassador to India.

By successful recycling, these surpluses could be returned to the consuming nations. But what about the constantly increasing oil prices? How to live with them? An important element in the recycling solution was to transfer to the producing countries the inflation that the high prices had caused in the consuming countries by charging the oil producers high prices for their imports from the industrialized countries.[96]

In December 1974 Washington established the US-Saudi Arabian Joint Commission on Economic Cooperation. Under the agreement SAMA purchased new US Treasury securities with maturities of at least one year. The interest on Treasury securities were pre-set and were therefore not accountable to the fluctuations that arise from traditional investment banking. The securities arrangement formed part of the main recycling device and went some way to ensuring that the US had a controlled stake in the rate of inflation in Saudi Arabia. From this point forth the rising oil price took on a different meaning in the US and UK and became more of an investment opportunity than an economic disaster.[97] The four main recycling devices adopted by the US and UK were:[98]

a) As mentioned above, producers were encouraged to invest in their customers financial markets such as government bonds and securities, corporate stocks and shares, and bank deposits and real estate.
b) Gulf producers were approached with attractive trade deals from major consumers. Trade included goods and services, and ranged from food to the construction of factories, schools and hospitals.
c) Major consumers offered the most advanced and sophisticated arms and ordnance to Gulf producers. Gulf producers were a ready market as they were eager to protect their assets from rival neighbours.
d) Producers sanctioned huge development projects managed by consumer countries. These projects escalated from a few hundred million dollars before 1973 to hundreds of billions of dollars by the late 1970's. The multi-million dollar

[96] Shwadran, Benjamin, *Op cit,* p. 133-134.
[97] It must also be said that from this point forth the Soviets began falling behind in the arms race as they lacked such an opportunity.
[98] Shwadran, Benjamin, *Op cit,* p. 134.

contracts could reduce balance of payments deficits, stabilize currency, reduce unemployment, and raise economic growth levels.

Despite the obvious benefits, upholding these four devices became the bane of successive western governments and the fallout habitually impacted on election results. The main causes of controversy among voters ranged from petrodollars appearing to; buy favourable financial treatment and endless luxury goods, create a corrupt arms trade and induce jealousy with their spectacular projects. Geopolitical comparisons at the time are stark. In the UK for example, the population was coming to terms with decimalization, revolt in the Colonies, entering the Common Market, suffering hardship because of crippling industrial strikes and fast approaching Heath's death Nell, the three day week. Conversely the picture painted by one UK businessman on a visit to Saudi Arabia was seemingly idyllic:

> **[In]…1975…[Jeddah] gained a more modern appearance. Numerous wide avenues were constructed to handle the increased traffic, lined with freshly planted palm trees. The old city became surrounded by new residential districts with palatial residences for the newly rich Arabian businessmen and officials. All of these new mansions were surrounded by tall walls to maintain their privacy. The old crowded, hot airport was replaced with a new modern palatial air-conditioned structure with opulent marble floors and walls.**[99]

The developing world faired less favourably. It experienced a severe economic downturn which led to the 1974 world food crisis. The crisis prompted developing countries to heavily borrow dollars on the international financial markets, resulting in the Third-World debt crisis of the 1980's and 1990's. In the US the mood among Washington's more astute military circles was measured:

> **[T]he combination of increasing oil import dependency and the ability of oil-producing countries to exercise over such a resource was salutary. The United States economy could be subject to a vulnerability that was as unexpected as it was serious.**[100]

America's exposed post-embargo position left open the possibility for US military intervention in future disruptions abroad. The process of petrodollar recycling was to

[99] Biega, Bill, Travel to Saudi Arabia in the 1970's, http://biega.com/arabia2.html
[100] Rogers, Paul, *Op cit*, p. 48-49.

underpin America's economic domination that funds its military supremacy. Petrodollars gave the US a unique ability to sustain yearly current account deficits, pass huge tax cuts, build a massive military empire of bases worldwide and still have others accept the dollar as a medium of exchange for their imported goods and services.[101] The embargo period left its official mark in that it provided the initiative for the US to form the International Energy Agency (IEA) based in Paris. As with OPEC the author classifies the IEA as a regulator/commentator rather than a disruption to the oil supply.

1976 Lebanese Civil War

1976 saw the end of Tapline as an international export route. Civil war in Lebanon together with general unrest in the region played a considerable part in the decision to close the line. But there were other economic factors to consider. The line could not compete with a tempting combination of importer friendly market positions. The collapse of tanker rates following the 1973 war, the new generation of VLCC's coupled with the opening of the Ju'ayma export terminal in Saudi Arabia formed a coterie that lowered the price of Gulf exports to the point where they pushed the cost of Tapline Mediterranean exports up into the red. The subsequent loss of custom made the line redundant, with the exception of supplying the Syrian and Lebanese domestic markets.

The line typically bowed out as an export route during a further dispute with Lebanon over transit taxes. The final dispute cost 18,000,000 barrels spread over two months. Ironically Tapline reopened again shortly afterwards to supply refineries in Jordan and remarkably Sidon in Lebanon again. Tapline ceased to be, per se, after Israel invaded South Lebanon in December 1983.[102] The lines asset's in the Levant were abandoned during the assault and in so doing brought to a close a line that Stevens wearily asserts was an operating experience 'abysmal in terms of interruptions to flow.'[103] Anthony Cordesman argues that Tapline could be reopened as an 'economically viable

[101] Clark, William R, *Op cit*, p. 28.
[102] Stevens, Paul, *Pipelines or pipe dreams? Lessons from the history of Arab transit pipelines,* Middle East Journal, Vol. 54, Issue 2, Spring 2000, p. 233.
[103] Stevens, Paul, *Ibid*, p. 224.

alternative' to lifting oil from the Gulf.[104] While the possibility cannot be completely dismissed consideration should be made to existing interstate relations along the route. However cordial they may be it might only take Tapline's potential for attracting trouble to regress these relations back to where they were thirty years ago. Tapline aside the rest of the Gulf pipeline network is built on a parochial system. None of the exporting states share a common pipeline or export terminal. Although the pipeline network promotes independence, it is also a good excuse for not supporting neighbours when they are in trouble. Past examples have shown that when one producer goes down, for whatever reason, they suffer alone while the others benefit from making up the shortfall.

1977 Damage to Saudi Oil Fields

The damaging effects of the overproduction of Saudi Arabia's main oilfields are a rare departure from the 'above ground' political and economic threats that are more traditionally associated with Gulf supply disruptions. While trying to keep pace with rising demand Saudi Arabia probably inadvertently caused the damage which resulted in oil becoming irrecoverable. Two accidental fires at the Abqaiq pumping centre also contributed to the predicament and set disturbing precedents. Damage to the field and pumping centre caused a shortfall of 700,000 barrels a day for about one month making a total of 21, 000,000 MB.

1978-1979 Iranian Revolution

The Iranian revolution was preceded by a term of strikes and unrest targeting the oil industry. The revolution prompted the Shah to flee into exile and turned Iran into a fundamentalist state. Given that Iran was the world's second largest oil exporter after Saudi Arabia the US declared that the loss of Iran's 3,500,000 barrels of oil a day was potentially more serious than the 1973 embargo. Over a thousand foreign workers employed in Iran's oil industry left the country, severely damaging production. A 1978 Rockefeller Foundation report provided an ominous warning:

[104] Cordesman, Anthony, *Op cit,* p. 313.

> **Political and security consequences likely to flow from a situation in which the deepening involvement of governments in the importing as well as exporting of oil - the consequence of anticipating shortage in such a strategic commodity – may too easily be accompanied by the sort of divisive competition among industrial countries (and also with and among developing countries) which corrodes relationships and endangers security.**[105]

As with previous shortages it was left to the remaining Gulf producers to make up the market shortfall during 1978, which they accomplished, but not before OPEC put the price of crude up. But the oil market was about to change forever. The Iranian revolution is notable for creating the 'competition among industrial countries' referred to in the Rockefeller report by altering the way oil is bought and sold.

Prior to the revolution the oil market traded on a fixed price capacity set by OPEC. The post-revolution market has centred on the volatile spot market:

> **Energy trading involves both the physical wet barrel trading of crude oil and petroleum products as well as the financial trading of oil on the futures exchange and on the over-the-counter (OTC) derivatives markets. The spot market is the physical daily market to buy and sell oil that is not under a long-term contract.**[106]

The spot market grew around refining centres. Oil and product surplus to requirements is sold to the highest bidder. The market is based around five major centres although the trading often takes place at locations around the globe. The five centres are: the Gulf of Mexico (the largest, out of Houston), North-west Europe (based around the ARA - Amsterdam-Rotterdam-Antwerp area, with the cargo market based in London), the Mediterranean (based on Italy's west coast), the Caribbean (the smallest) and the most recent and fastest growing member, Singapore. The market is driven by teams of brokers and traders. Brokers do not take a position in the market. They solely act on a commission basis as intermediary between a buyer and seller, often keeping the identities of the buyer and seller a secret until the deal is arranged. Traders take positions on the market. They expose themselves to large financial risk and equally large reward, buying and selling speculatively rather than just to offset supply and demand. Oil bought by traders is stored in huge tank farms until it is finally

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[105] Drafter, Ray, *World Oil Production and Security of Supplies,* International Security, Vol. 4, No. 3. (Winter, 1979-1980), p. 164.
[106] Bloomfield jr, Lincoln P, et al, *Op cit*, p. 50.

sold and collected. Crude oil, as cargo on the market, can move through as many as thirty trades before delivery.[107] The unpredictable nature of the spot market was further increased when markets began utilizing new satellite communication technology to gather information. Transmissions were much faster than before and the volume of traffic threw traditional decision making practices into disarray.

The switch to the spot market started when Iran began to falter. This caused certain smaller independent oil companies to be caught short, so they bought oil from the spot market, which at the time accounted for only 8% of the total market share until:

> **In 1978, the changing structure nature of the physical spot market for oil presaged the development of energy futures with the successful launch of the New York Mercantile Exchange (NYMEX) heating oil futures contract, which was tied to physical delivery in New York Harbor. Successive oil futures contracts and the development of an active OTC market for forward oil trading in the early 1980's significantly increased price transparency, and thereby boosted both physical and financial trading of crude oil and petroleum products globally.[108]**

As the spot and futures market developed, it pushed the price of crude up to the point where many new agreements that would have been sealed under the traditional fixed price contracts became economically unviable for producers to enter into. Iran saw opportunity, defied OPEC, and began selling its oil almost exclusively on the spot market.

Iran's policy reversal spun producers and consumers worldwide into a 'Putnam like' spin, where sales became 'very erratic, and...[where]…market prices vary daily, thus making any planning by the consuming nations or the oil companies impractical.'[109] Serendipity literally shone on the Iranians. The spot market offered a number of other unwelcome complications for major consumers. The market gave rise to a subtle putsch in which traders, acting for consumers, openly competed commercially against one another for a share of the market, as opposed to governments competing for the individual favours of producers. However, individual consumers had to take particular

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[107] Clubley, Sally, *Trading in oil futures,* Nichols Publishing Company, New York, p. 27-34.
[108] Bloomfield jr, Lincoln P, et al, *Op cit*, p. 18-19.
[109] Fatemi, Khosrow, *The Iranian Revolution: Its Impact on Economic Relations with the United States,* International Journal of Middle East Studies, Vol. 12, No. 3. (Nov., 1980), p. 310.

care that their government policies, aimed at individual producers, did not clash with the policies of rival consumer states or the business policies of their own traders, to create a conflict of interest or ‘mutually assured disruption’ of a particular producer’s supply.

The KSA oil infrastructure is a vast long term investment opportunity and in its simplest form works on a cycle of profit from oil sales being fed back into Research and Development ‘R&D’ projects, from which more oil can be extracted from depleting fields. Foreign companies can only invest in R&D projects if the oil fields will remain productive for long enough to pay off the initial outlay. Therefore the continuing and unhindered flow of export oil serves as a guarantee that any loans to finance R&D projects will be paid off. If, for any reason, the KSA oil supply chain were to be seriously disrupted, the result may be a reluctance for financers to agree loans to service providers developing tools for projects in the KSA.

Developing countries on the brink of socio-economic investment were the unfortunate casualties of the spot market. They could not afford to gamble their meagre economic security on an uncertain futures market. The fortunate were spared stagnation, but the price paid by those countries can appear meretricious. The cost involves sustaining a dynamic economy. However, the dynamics required to fund a participant’s stake in the game quickly led players to open and close their political jaws on, for example, a fluctuating employment market, a switch from manufacturing to service industries and disproportionate mortgage interest rates and house prices in order to generate enough capital for banks to hedge on the market. The price exalted later laid waste to generations of previously productive workers, heaped debt on the shoulders of the younger generation and accepted that State benefits are in fact a form of income in order to obtain credit. In short, the lifestyle choices of major consumers altered as a result of absorbing these new dynamics. Lifestyles now offered new opportunities such as ‘two car families’, extra cash from tax cuts due to reduced public expenditure, a shorter working week offering more leisure time and cheap foreign package holidays. These opportunities promoted independence from the state but impacted on the demand and consumption rate of the oil supply – both determining factors of oil and wider market stability.

The period suffered two further shocks. Iranian exports eventually stopped completely, leaving behind a vibrant and continuing spot market, and Saudi Arabia announced a 9.5 million barrel per day cut in production for the first quarter of the year. The Saudi cut underscored the point that US had far less influence over Saudi Arabian policy than they may previously have believed. By February 1979 the spot prices were double official prices which led to other producers joining the spot market in a free for all. Representatives at a G7 summit held in Tokyo later that year declared:

> **[The] unwarranted rises in oil prices mean more worldwide inflation and less [economic] growth. That will lead to more unemployment, more balance of payment difficulty, and [will] endanger stability.**[110]

Inflation, lack of growth, unemployment and economic instability spelt ruin for both customers and producers alike. Saudi Arabia appeared to understand. It tried to alleviate the situation by appealing to the US for a reduction in consumption but the appeal inevitably failed.

Tanker rates increased slightly but the rise did little more than cover the cost of the voyage. Once again the tanker industry had to conform, this time to the new trading patterns caused by the spot market:

> **[T]he oil trade had changed from a predictable trade for which transport was carefully planned by the oil companies to a volatile and risky business in which traders played a substantial part and transport was, to a large extent, left to the market place to manage.**[111]

The traders, with little or no assets of their own, had a different approach to risk which affected transportation rates. Five years later a well-respected industry journal commentated on the difficulties faced by tanker owners trading on the spot market:

> **The last ten years of capital drain in the tanker industry have no historical precedent and we have witnessed a decimation of shipping companies which has probably no parallel in modern economic history…The surviving members of the independent tanker fleets must be akin to those of the world's endangered species whose survival appeared questionable**

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[110] Shwadran, Benjamin, *Middle East Oil Crises Since 1973,* Westview, London, 1986, p. 153.
[111] Fatemi, Khosrow, *Op cit,* 309.

in a changing and hostile environment, but have instead shown a remarkable ability to adapt. [112]

Unfortunately the following decade was to be even worse for tankers, their owners and crews alike. The 1979 Iranian revolution cost the world 3.6 million barrels per day in lost production, induced the rise of the spot market and introduced a regime that fast became a nemesis to the US and later Israel.

1980-1988 Iran-Iraq War

In December 1979 the Soviet Union invaded Afghanistan. In doing so the Soviets encroached on the Gulf region. The invasion prompted the previously mild Carter administration to issue the following proclamation which subsequently became known as the 'Carter doctrine':

> **Any attempt by outside forces to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States, and such an assault will be repelled by any means necessary, including military force.**[113]

The statement proved to be ambiguous. In 1980 Iran and Iraq declared war on each other in order for the winner to, ironically, gain control on the Gulf. Rather than choose direct involvement in the war the US and other western powers chose instead to back Iraq against Iran in the 8 year long conflict.

The two warring parties further involved the international community when they decided to target their adversary's oil exports in order to weaken each other's economic position. The resulting 'tanker war' will be discussed in greater detail in a later chapter but Farzin Nadimi provides the following commentary in relation to the oil supply:

> **The Iranian oilmen showed extraordinary skill and courage in dealing with superior airpower which was supported by all world powers. Their actions in keeping the flow of oil running…disrupted or delayed most of Iraq's plans…The Iran-Iraq War clearly**

[112] Stopford, Martin, *Op cit,* p. 64.
[113] Maugeri, Leonardo, *Op cit,* p. 128.

demonstrated that while oil facilities may be highly vulnerable to attack individually, the oil production and shipping infrastructure itself is less vulnerable even under the shadow of an occasionally determined campaign.[114]

Tankers proved to be particularly resilient especially when loaded. Hooton and Navias argue that 'The sub-compartmentalization of tankers made them especially difficult to sink.'[115] Following penetration of the hull, the impact of missiles tended to be absorbed by the oil in the cargo tanks which were further protected by inert gas. They also argue that in many cases tankers hit and then certified total losses for insurance purposes were victims of the economics of 'the shipping market rather than the damage inflicted.'[116]

Tankers have over the years played a crucial part in exporting oil from the Gulf. Again, discussion of the tanker industry in the IR, Security Studies and wider Social Sciences has been moot. Tankers have developed alongside major conflicts in the Middle East. Earlier I postulated that 'one problem solved is often another waiting to happen', which is exemplified in development of modern oil tanker design. After the closure of the Suez Canal in 1967 oil tankers were enlarged to carry more oil on the longer route to the west via the Cape of Good Hope.

Shipping companies therefore chartered bigger vessels until the Very Large Crude Carrier 'VLCC' became the norm on the Gulf – West route, so much so that the vessels are so big that they cannot fit into most loading berths at other loading terminals in other export states. Security within the shipping industry is often levelled at the potential for radicalization among crew members, the condition of Flags of Convenience vessels and environmental factors, when in fact a major disruption to shipping in the Gulf available tonnage would result in a severe shortage of vessels able to load oil elsewhere (as discussed in chapter 6). The tanker industry was aware of the situation and would probably capitalise on the situation – overlooked by the social sciences. Nonetheless, attacks on vessels during the Tanker War were sobering:

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[114] Nadimi, Farzin, *Kharg and the Iran-Iraq War,* Paper delivered at the 2007 Gulf Conference (Exeter University, July 2007, p. 21.
[115] Hooton, B.R, Navias, Martin S, *Tanker Wars,* Tauris, 1996, p. 216.
[116] *Ibid,* p. 278.

A typical [sic] attack on a tanker is recounted by Captain Bruce Ewen, master at the time of the 412,000 dwt World Petrobras which was bombed by Iraqi jets on 22 December 1987. At the time the tanker was providing floating storage off Iran's Larak Island in the northern part of the Strait of Hormuz. Two Russian made 500 lb bombs with parachute drogues attached dropped onto the main deck during the attack by Mirage jets, which also hit two other tankers off the island

World Petrobras was at the time transferring oil from one tanker, Free Enterprise, onto another, British Respect. 'When the bombs struck,' Ewen recalls, 'the rubber hoses attaching us to the British Respect were set afire and a large amount of shrapnel from our deck fittings blew through the side of the British Respect. Since we were both inerted and had our inert gas plants running, an explosion was avoided. However, we needed to get British Respect away from us so we could get firefighting tugs alongside.

'We cut her aft ropes and her master went ahead on the engines and ran the forward ropes off the reels. When she parted the hoses, a large amount of oil was dumped into the water which caused a large fire and set the rubber fenders ablaze. Although this rendered our lifeboat and life raft on the post side beyond use, the current was fairly quick so the danger passed in a fairly short time. The World Petrobras resumed operations 42 hours later. [117]

Although individual attacks were horrific fortunately in all only about 2% of shipping was affected during the conflict. In 1984 Saudi Arabia opened a new export terminal at Yanbu on the Red sea coast. Oil for export is pumped 745 miles from Abqaiq along the Petroline pipeline. The terminal is now reported to be under developed.

The war ended a stalemate in 1988. Iran and Iraq's production levels wavered at the outbreak of war costing 297,000,000 barrels of oil per day between them however the total output from the Gulf was unaffected. Saudi Arabia acted as a 'swing producer' again to make up for the shortfall. Saudi also made it plain that they were able to increase production while coping with the stress of possible attack. It would appear that, exposure to conflict aside, Gulf producers kept their customers happy enough to stave off their direct involvement. At no time during the War were any of the Gulf States invaded or occupied by armies controlled by major consumer states.

[117] Devanney, Jack, *Op cit,* p. 31-32.

The rise of Al-Qaeda

The period also gave rise to the world's most infamous terrorist group. Al-Qaeda, headed by Osama Bin Laden formed in 1989 as Soviet troops withdrew from Afghanistan. The highly motivated and battle hardy group began looking for new holy wars or 'jihads' to wage.

Also in 1989 the tanker *Exxon Valdez* ran aground in Prince William Sound, Alaska. The resulting oil spill proved to be a hugely expensive public relations disaster for Exxon. More importantly the US government passed the Oil Pollution Act which called for the phasing out of single hulled tankers in US waters between 1997 and 2000, in favour of double hulled ships (see fig 2.6 cross section of a double hull tanker).

Fig 2.6 Cross section of double hull tanker

However, an oversight occurred after the 1989 Exxon Valdez oil spill. US and European Law decreed that only double hulled tankers would be able to enter their respective ports. As such tanker design changed again to incorporate these new environmentally driven laws. The new double hull design has not been discussed among available literature in relation to the damage sustained by oil tankers during the 1988 tanker war in the Gulf. The overall resilience of tankers, taking into account the frequency and impact of attacks was surprisingly good – but how the double hull design will react is not mentioned.

1991 Kuwait Oil Well Fires

Iraq had always laid claim to Kuwait being its nineteenth province. During the run up to war Iraqi President Saddam Hussein blamed Kuwait, among other issues, for frenetically pumping crude from its Rumaila oilfield that straddles the Kuwait-Iraq border. Kuwait found security by increasing its proven reserves. No sooner had Iraq invaded Kuwait when a coalition of western forces led by the US had formed to repel the Iraqi forces and prevent them from marching into Saudi Arabia and on to the Emirates. US President George Bush explained why America could have never accepted Iraq's threat to the Gulf:

> **Our jobs, our way of life, our own freedom and the freedom of friendly countries around the world would all suffer if control of the world's great oil reserves fell into the hands of Saddam Hussein.**[118]

It took the coalition forces just under one hundred hours to liberate Kuwait. Shortly afterwards the troops withdrew from the region. Iraqi forces retreated back to Baghdad leaving behind an abhorrent crime. Upon their retreat Iraqi troops set fire to Kuwait's oil wells thereby causing one of the worlds worse environmental disasters.

Iraqi troops had packed plastic explosive around the well heads or 'trees' and covered them with sandbags. The force of the explosion was tremendous. In some cases the blast took the head clean off the stem but in others the casing just fractured slightly and oil sprayed out of the cracks at obtuse angles. The Kuwaiti government implemented the Al-Awda project to extinguish almost 700 well fires. Before leaving the Iraqi's removed all the tools, vehicles and housing from the fields so everything necessary to cap the wells had to be imported. Teams arrived from the US, Canada, Britain, Russia, Romania, China, France, Hungary and Iran to join forces with the resident Kuwaiti team of fire fighters.

Engineers faced enormous challenges such as building roads and sourcing equipment. The wind was a severe problem, although the oil spilled onto the desert floor held the sand down during squalls. The gathering system was pumped full of

[118] Maugeri, Leonardo, *Op cit,* p. 148.

water to create huge artificial lakes. Water was played on the fire before it was finally extinguished and capped. Capping methods ranged from plugging the well vertically with a huge metal spike, to a Hungarian invention that literally blew out the fire using a pair of jet engines mounted on the body of an old Soviet tank. Teams also had to work around unexploded bombs and discarded military ordnance.[119]

It was expected that the fires would take years to extinguish but the project surpassed all expectations. The reigning Emir of Kuwait ceremoniously extinguished the last well fire in the Burgan field only 229 days after the first teams began work. Cordesman remains resolute. He argues that:

> **Though fires can be set in many areas of a working field, including at oil wells, fires do not produce critical and lasting damage. Unless wells are attacked with explosives deep enough in the wellhead to result in permanent damage to the well, most facilities can be rapidly repaired.[120]**

The disruption lost approximately 250,000,000 barrels of oil plus the cost of the project which ran to approximately $3 million a day or $708,000,000 overall. The project was a model of international cooperation. More than 10,000 non-military personnel from 40 countries supported the fire fighters.

Attacks on pipelines are reasonably easy to repair as long as the environment is safe to work in. The oil supply can be shut off without damage to the rest of the infrastructure. Available literature does not place emphasis on the key installations which could potentially create a larger disruption if they were to fail or come under attack. For example the retreating Iraqi army destroyed the Kuwaiti oil fields because the Iraqi's knew that the Kuwait National Petroleum Company had omitted to fit blow out prevention devices down in the oil wells. Had Kuwait done so then the Iraqi army would have been less successful (as discussed in Chapter 6).

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[119] In one instance, a crew decided to try out an Iraqi antitank weapon. The door was open on their pickup and the brave soul holding the weapon was standing in front of the open door aiming at an abandoned tank. He fired and his aim was true. However, the backfire from the weapon opened a neat hole in the door of his vehicle.

[120] Cordesman, Anthony, Al-Rodhan, Khalid, *The Global Oil Market: Risks and Uncertainties,* CSIS, Washington 2006, p. 63.

Events following the Gulf War were less encouraging. Osama Bin Laden focused his jihad on America and Saudi Royal family. In 1995 Al-Qaeda bombed the Saudi Arabian National Guard Headquarters in Riyadh. A year later they attacked the Khobar Towers US Air Force residential complex in Dhahran killing nineteen American servicemen. Almost a decade after the end of the Iraqi invasion of Kuwait Saddam Hussein invited Washington's wrath when he announced that Iraq would transition its oil export transactions in the Euro currency, but future events were to prevent the Iraqi dollar-Euro shift.[121]

September 11th 2001

The September 11th 2001 '9/11' terrorist attacks on New York and Washington DC placed the US-Saudi alliance under considerable stress. Fifteen of the nineteen terrorists were Saudi nationals. It is still unclear how far reaching the impact of these events will be but the overarching message attached to the response has been that the US was largely unprepared for such an attack. Furthermore the attacks are a brutal reminder of the importance of Middle Eastern politics to the rest of the world, not only because of oil. The period following 9/11 was dominated by the War on Terror, a US led coalition to bring Al-Qaeda leader Osama Bin Laden to justice and also rid Afghanistan of the Taliban.

The Bush administration began to broadcast its growing unease towards Saddam Hussein. Congress succeeded in introducing a raft of security related international laws, such as the International Maritime Organization backed International Ship and Port Security Code (ISPS) together with a complete overhaul of security procedures relating to the civil aviation industry. None of the 9/11 targets were directly oil related. However the shock waves created by the incidents percolated quickly up into the oil industry and made a substantial impression on the market. Analysis of this mechanism and that of subsequent published material relating to 9/11 is best covered elsewhere in the thesis.

[121] Clark, William R, *Op cit*, p. 28.

Al-Qaeda has instigated surprisingly few large scale attacks against the oil infrastructure although the group have succeeded in hitting a number of important targets. A year after 9/11 Al-Qaeda attacked a VLCC off the coast of Yemen. The tanker was built to the new environmentally friendly 'double-hulled' design. The event was followed with a great deal of interest by insurance companies and ship owners alike, as until this point it was unknown how a double-hulled tanker would react in a combat situation.

The post 9-11 mistrust between the US and Saudi Arabia, coupled with extreme resistance within Saudi towards stationing US troops on Saudi soil, resulted in US military forces leaving Saudi Arabia for neighbouring Qatar. Fear also drove an exodus of ex-pats from the region. Cordesman argues that as a result of the changing dynamics of the region, visiting businessmen can also become terrorist targets because they 'seek to put economic pressure on local regimes or prove their status and power.'[122] Business however was not all bad. As the US began to distance itself from Saudi Arabia, China moved in to fill the gap. China soon overtook Japan to become the world's second largest importer of oil with an agenda to foster stronger ties with Saudi Arabia. A further development was the unprecedented rise in the price of oil. The rise can be partly attributed to the extra cost of providing security for the oil infrastructure, but the market has been sympathetic to applying the 'fear factor'. It can also be argued that in sustaining the high price of oil the market is displaying an overall loss of confidence in the region. A key international post 9/11 Ministerial seminar identified this loss of confidence in four main geopolitical problems namely; increased instability in Saudi Arabia, Iran and Iraq, pressure from the US, managing the younger generation and Islamic fundamentalism.[123]

Iraq disarmament programme

The problems connected with 9/11 increased when Iran announced it was actively pursuing a nuclear programme and if attacked by the US it would close, without explaining how, the Strait of Hormuz. The ambiguity continued. In October 2002 the

[122] Cordesman, Anthony, *Op cit,* p. 104.
[123] McPherson, Hugo, et al, *Emerging Threats to Energy Security and Stability,* Springer, Dordrecht, 2005, p. 197-203.

US Senate voted in favour of utilizing military force against troublesome Iraq, all be it on the back of some challenging evidence. The evidence displayed in front of the Senators is still viewed as being supported by either rafts of overwhelming, or misbegotten, intelligence (depending on one's own individual standpoint regarding the legality of the impending war). In November Iraq accepted UN Resolution 1441 which it responded to a month later with a 12,000 page weapons declaration. However, the UN and US stepped up the pressure because they both felt that the dossier still failed to account for Iraq's chemical and biological weapons. In February 2003 Tony Blair's UK Labour government dramatically released a glossy dossier of evidence supporting the need for war, namely that Iraq almost certainly did indeed possess weapons of mass destruction. The manner by which journalists digested this and other Anglo-American treatise only added to the confusion. Global communication corporations were duly routed into broadcasting, leading investigations starring colourful politicians interviewing lines of 'A' list celebrities to discuss political guile, just war theory and Saddam Hussein (but rarely the Ba'ath Party). The media further compounded the issue by programming non-shock exposes dealing with the black art of government reports, official inquiries and spin doctors. Blair later marshalled:

> **The truth is faced with this struggle on which our own fate hangs, a significant part of Western opinion is sitting back — if not half-hoping we fail — certainly replete with *schadenfreude* at the difficulty we find.**[124]

Regardless of the media attention viewers on both sides of the Atlantic were powerless to do anything much except continue to tune in and watch the situation marshal further towards conflict which eventually became a reality on March 20th 2003.

Just before the Invasion in November 2002 the Bahaman registered tanker *Prestige* broke up and sank in the Bay of Biscay. Irate Fishermen in Northern Spain took to the streets in protest over marine pollution, prompting Spain's new Labour government into action. As a result the IMO moved the final phase out of single hulled tankers in European waters back from 2015 to 2010. The move was immediately effective in that all new build tankers from 2003 onwards would be double hulled tankers.

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[124] Zinsmeister, Karl, *The Real Iraq Story,* http://www.nationalreview.com/comment/zinsmeister200408040849.asp

Ironically the double hulled design included large areas of un-innerted hull space which could ignite (especially if the circumstances such as those found in the 'tanker war' repeated themselves).

2003 War in Iraq

The ongoing ethical debate concerning the US led invasion of Iraq is now almost comparable to the debate that still surrounds the atomic explosions at Hiroshima and Nagasaki. The invasion lived up to the US goal of the capture and eventual execution of Saddam Hussein but the subsequent regime change failed to unite Iraq. The country fractured and its oil infrastructure eventually broke down:

> **In 2003 the US and UK Occupying forces abolished the army and the police without providing a substitute to restore security and enforce law and order. The impact on the oil industry of the lack of security has been devastating. Iraq oil industry has suffered from continuous sabotage of oil installations and pipelines, reducing the ability of Iraq to export its crude oil; kidnap and killing of oil engineers, technicians and employees resulting in the loss of human capital needed to run the industry; and the smuggling of crude oil and products by militias and gangs and corruption at all levels, which has deprived the government from revenues needed for necessary maintenance and investment.**[125]

The pipeline between Kirkuk and Ceyhan was damaged by terrorists so badly that it was closed completely. Elsewhere, Al-Qaeda attacked a housing complex in Saudi Arabia and attempted to penetrate the Abqaiq pumping station. The assailants were repelled before they could do any damage. The incident played testimony to the heavy security that now protects Saudi's oil infrastructure.

Post-War events in Iraq further reshuffled the threats. Shia/Sunni politics semi-eclipsed the Arab-Israeli question and Al-Qaeda capitalized on the continuing unrest. In 2004 a video tape broadcast on Qatar's Al Jazeera TV station Osama Bin Laden ordered his followers to 'stop the greatest theft in history' by focussing future operations on '[oil production], especially in Iraq and the Gulf area, since this [lack of

[125] Fattouh, Bassam, *How Secure Are Middle East Oil Supplies?* Oxford Institute for energy Studies, September 2007, p. 10.

oil] will cause them to die off [on their own].'[126] Regardless of the threats China increased its Gulf imports and the oil market remained buoyant which in turn increased supply:

> **Oil's commoditization also has influenced the broader energy economy. Today, the price of oil on a forward curve for NYMEX or London's International Petroleum Exchange (IPE) affects drilling activity more profoundly than may be commonly realised. The markets react to continuous price volatility, which is a function of commodity markets in a situation of supply/demand imbalance. The influence of the commodity markets is undeniable, no matter how reluctant OPEC producers are to become actively involved with either exchange-traded futures contracts or OTC financial oil price swaps. Producers of oil are evidencing a newfound appreciation of the significance of price volatility and the role of hedging in their own short-term strategies.[127]**

Lord Browne, Chairman of BP assured (international) shareholders:

> **£1 out of every £6 that goes to UK pension funds in terms of dividends comes from BP. The profits of BP and other companies support pension funds that are not in a very good shape.[128]**

Lord Browne's remarks could almost be said to have shifted Putnam's well-oiled mechanism into gear. Tanker rates soared and the hurricanes that battered the Gulf of Mexico, shutting production, helped to raise the price of oil again. There was an overall shortage of tankers due to Chinese imports draining the market. The price for hiring a VLCC on a Middle East-Far East cycle was pegged at $82,300 a day.[129] In October and November 2004 the rate hit an unprecedented $200,000 a day.[130] Again, the Gulf awoke to a dawn of new challenges, the shadows of which were to cool previously warm friendships.

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[126] Excerpts of Bin Laden message: http://news.bbc.co.uk/1/hi/world/middle_east/4103137.stm
[127] Bloomfield jr, Lincoln P, et al, *Op cit*, p. 19.
[128] http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article728400.ece
[129] Morrison, Kevin, *Tanker owners strike black gold as freight rates climb,* Financial Times, London, 23/03/04, p. 36.
[130] Wright, Robert, *GMC would welcome cash shipment,* Financial Times, London, 22/01/05, p. 8.

Conclusion

In general pre-9/11 threats predominantly impinged upon the mid-stream, namely tankers or pipelines, as opposed to affecting other sectors of the oil industry. However, it is noticeable from existing literature that technical analysis of the mid-stream is severely lacking among current published work. The overriding interest concerning most current literature lies in analysis of issues contributing to the high price of oil. The sustained high price of oil has certainly laid great weight to the decision making process, but is the price of oil representative of the threats?

Scholars and analysts of the Gulf region are already advancing thirty year forward projections concerning supply and demand. The accuracy of the exercise is questionable. After all it would have been truly exceptional if just before the 1973 oil embargo a forward projection incorporating all the above disruptions were advanced. But maybe that would be expecting too much. It's probably more realistic to argue that regardless of disruptions enough oil has managed to flow out of the Gulf to meet demand and keep the US on top of the world economy. So far success appears to derive from producers being periodically challenged, but never overcome, by a succession of political and/or economic threats which were fairly predictable until 9/11.

9/11 shifted America's stake in the Gulf away from direct imports and on to the complexities surrounding market security. America freely admits that it remains dependent on Gulf oil, although the dependency is opaque. Its dependency can just as easily be interpreted as a reliance on Gulf oil reaching the market. The market in turn drives the global economy of which the US contributes the greatest percentage. Conversely China and other Far Eastern customers have confidently usurped America's export share.

Analysis infers that during the 1960's and 70's disruptions centred on the closure of Suez due to the Arab-Israeli conflict. Today it is highly unlikely that Suez will close for any significant length of time. Emphasis on closures has shifted east. The Strait of Hormuz has always been a key strategic waterway. Maintaining free passage through the Strait is key to preserving market stability. China also has a greater stake in Hormuz than it did five years ago. Iran is the protagonist. Iran has threatened to close

the Strait if the US acts against its nuclear programme. Oil Tankers are virtually irreplaceable as a mode of transport and will continue to play a capital role in market stability. But the industry has undergone a substantial structural change that has yet to be fully examined.

From the 1980's onward Iraq's assertions replaced the Arab-Israeli conflict in terms of disruptions. Iraqi forces have fought against Iran, Kuwait and a two US led coalitions. Recently war has given way to terrorism. It is difficult to predict whether Al-Qaeda will win or lose support in the region. The prospect of further terrorist action would challenge the safety of foreign ex-pat oil workers across the industry sectors.

Finally, culture within Gulf States has come under scrutiny. Fundamentalism and the younger generation have been identified as areas of concern along with unemployment, education, mass communication and high expectations.[131] The significance of these issues towards maintaining political stability in Saudi Arabia remains unsure.

Supply disruptions in the Gulf are primarily viewed as negative due to the resulting rise in the price of oil. However, disruptions do have the desirable effect of opening up new resources, although not without additional analytical discord exemplified here in the 1973 Arab oil embargo. Paul Wolfowitz cites the embargo as the first and only time that Gulf oil was seriously used as a political weapon.[132] He further argues that although the embargo was short and had a limited effect, the political ramifications were far greater. The US made a threatening response to the incident which Wolfowitz claims 'drove a wedge between the United States and its European Allies…that lasted…right up until the Gulf War.'[133] Giacomo Luciani disagrees, he argues that 'oil was never used as a weapon' instead he declares that the 'embargo was fictional…[although]…commentators still refer to…[it]…as…a…dangerous precedent

[131] One Gulf national, an oil industry manager, exclaimed 'We must think differently now. That is a real challenge for us and states like us. When I look at my office, my house, I think, have we created this? No, we have imported it. Importing is not bad in itself, but we have to create things as well. This will bring jobs. It is certainly difficult for this generation. The wealth is decreasing with the declining population.
[132] Or a tool of foreign policy. See Mitchell et al, *op cit*, 2005, p. 261.
[133] Bloomfield Jr, Lincoln P, *Global Markets and National Interests: The new geopolitics of energy, capital, and information,* CSIS, Washington DC, p. 188.

and proof of unreliability of Gulf oil supplies.'[134] The same embargo did however guarantee the development of the North Sea oil fields although it was not nearly as favourable to the shipping industry as Intertanko reported,

> **'The demand for tanker transport suddenly collapsed. Oil companies who had also been building up their fleets had little enough work even for their own ships. Bunker fuel shot up in price and also became harder to obtain, and naturally the oil companies prioritized bunkering their own ships. So even where charters were to be had, independent owners had no certainty of obtaining the bunker fuel to prosecute the voyage.'[135]**

The tanker market only recovered when price and demand stabilized. The disruption caused by the Iranian Revolution lifted the price of oil enough to make Angola's offshore oil fields ripe for exploitation. Control of the oil though sparked off a war but the geographical location of the fields ensured a safe loading environment for exporting tankers. It is also hard to deny that the 1990 Gulf War allowed Russia to pitch her Siberian and Sakhalin fields to private investors as a viable alternative to Middle East oil and gas. Disruptions in the Gulf are also responsible to some extent for the Research and Development of new technology currently being used to exploit the Canadian tar sands, Russian Arctic and deep sea drilling worldwide. Disruptions initially hurt but do eventually open up further opportunities – at a price!

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[134] Luciani, Giacomo, *Oil and Political Economy in International Relations of the Middle East,* International Relations of the Middle East, Oxford University Press, Oxford, 2005, p. 89.
[135] Anon, *The Oil World In Turmoil-Jorgen Jahre 1973-1976,* http://www.intertanko.com/templates/Page.aspx?id=1073

CHAPTER 3

Bayesian methodology

As highlighted in chapter two the risks facing the oil supply chain were dynamic. Threats were both accidental and intentional, and could be primarily targeted directly at the supply chain or impacts of a secondary nature where the supply chain was not the primary target. In the case of oil tankers, threats emerged as their design evolved. This being the case when selecting a suitable methodology to calculate risk to the Saudi oil supply chain the methodology will need to be indefatigable and pragmatic for the results to display reason and accuracy.

Data for the thesis was also gathered during a field trip to the SAOGE 2008 Exhibition. A brief summary of the field trip can be found at the end of this chapter. A full account of the field trip is placed in an annex at the end of the thesis.

Research methods

Keith Punch indicated that there are five main factors that should be taken into account when selecting a suitable research method.

The first factor is the research question itself. Punch states that the research question is at the core of every individual study, and must be addressed adequately. Punch argues that 'different questions require different methods to answer them'.[137] It is necessary therefore to ensure that the research question remains the most important factor throughout the process and not methods to which research questions are adapted to.

The second factor to consider is the nature of the research outcome. This thesis required detailed study and analysis of the topic as opposed to comparing numeric data.

[137] Punch, Keith F, *Ibid,* 1999. P. 244.

The third factor is a review of available literature on the topic including previous academic studies on the same topic or topics aligned to the thesis. Available literature pertaining to this thesis came from a variety of academic and industry sources. In some cases the there was no clear record of subject matter except from data collected during interviews.

The fourth factor concerns practical issues. The consideration of finance, time management, access to and the cooperation of key individuals and places had to be accounted for during the project.[138]

The fifth factor determines approach. Which approach would produce appropriate knowledge about the topic and which approach would generate the required information about the topic? The thesis would require widespread analysis of the KSA oil supply chain and potential risks that threaten it. The results of the analysis will then be assessed in a scaling process.

The five factors are all incorporated in the research framework below.

Research framework

The disruptions highlighted in chapter two vary in their causation so the chosen methodology will have to be flexible enough in its structure to accommodate emerging and unforeseen threats. Keith Punch provides a suitable research framework fig 3.1 below[139]

Literature **Theory**
↓ ↓
Research area → Topic → Questions → Hypotheses → | Design → Data collection → Data analysis → Test hypotheses
↑
Context

Pre-empirical stage ***Empirical stage***

Fig 3.1 Research Framework

[138] Punch, Keith f, *Op cit,* 1999. P. 244.
[139] Punch, Keith F, *Introduction to Social Research Quantitative and Qualitative Approaches (Second Edition),* Sage, London, 2005, p. 40.

Due to the diverse nature of the threats analysed, the thesis will not be limited to a particular set method of data collection. Data will be gathered from existing literature, interviews and exhibitions (pre-empirical stage). Data collected for this stage required a field trip to the 2008 Saudi Arabia Oil and Gas Exhibition (SAOGE) in Dammam. A field trip report can be found at the end of this chapter.

As the thesis will not attempt to quantify and calculate the amount of oil transiting the supply chain, the research will centre on threats to the physical infrastructure namely the oil wells, pipeline delivery system, oil tankers and associated personnel. Research will take into account the persuasive self-interest that can accompany the oil industry's attitude to threats and risk which are often played down to pacify shareholders. Therefore the methodology selected for the analytical (empirical) stage must be robust and impartial.

Selecting a suitable research method

The thesis could benefit from several methods of collecting and analysing data. A review of available literature is mandatory but there are a number of alternative methods for collecting data from individuals. However, two examples, focus groups and a Delphi questionnaire[140] appeared too adventurous when similar results were obtained by requesting individual interviews. Organizing experts into a focus group would require a great deal of time and coordination. Constructing a Delphi questionnaire would require similar input to a focus group, with no guarantee of any replies. Interviews proved to be an adequate substitute for both methods.

Anthony Cordesman's suggestion to utilize Bayesian methodology came to light during research for the initial literature review at the beginning of the project. After further examination and research Bayesian methodology became a strong contender for processing the expected data and providing accurate results thereafter.

[140] http://www.rand.org/topics/delphi-method.html

Applying Bayesian methodology

Taking the above into account, the thesis will adopt a Bayesian methodology deriving from Bayes theory. Cordesman suggests that,

> **'There is a clear need for an assessment of what kinds of sudden events or discontinuities are critical and for some form of Bayesian approach to risk analysis.'**[141]

Anthony Cordesman's plea for clarity could be seen as a response to the vicissitudes following 9/11.[142] Contemporary analysis of the oil industry can quite rightly be accused of focusing on one main issue, namely the risks accompanying high oil prices. However, in shaping this drama, actors such as political, economic, security and energy market analysts appear to struggle when cross-referencing each other's data.[143] It may be that the data is commercially sensitive but as a result the conclusions, and the factors that influence them, overwhelm the simplicities of traditional 'combining ideas' theories.[144] Instead the heady confluence forms a melange of technical, linguistic and tangential conjecture from which clarity, as Cordesman argues, struggles to emerge. In short the dramatists have a tendency to pen emotive, as opposed to pragmatic, analysis of the risks affecting the global energy supply chain as, among other factors, it could well be in their business interest to do so.

The Bayesian approach to risk

Colin Howson and Peter Urbach posit that the decision making process is frustrated because scientists discriminate between possible explanations. They 'typically pick

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[141] Cordesman, Anthony H, Al-Rodhan, Khalid, *The Global Oil Market: Risks and Uncertainties,* CSIS, Washington DC, 2006, p. 20.

[142] The quote is taken from research under the heading 'Inadequate modelling based on inadequate understanding'. Cordesman also cites under the same heading: parametric analysis, Economic growth rates, Country plans, indirect imports, Technological improvements, Relation of oil prices to demand for alternatives and conservation and supply and demand elasticities. *Ibid,* p. 18.

[143] Baumgartner and Jones argue that 'Experts in all areas spend much of their time convincing others that 'outsides' are not qualified to make decisions in a given area.' See Baumgartner, F and Jones, B.D, *Agendas and instability in American politics,* Chicago, Chicago University Press, 1993, p. 235.

[144] Hadamard wrote 'Indeed, it is obvious that invention or discovery, be it in mathematics or anywhere else, takes place by combining ideas' Zellner, Arnold, *Bayesian and Non-Bayesian Approaches to Scientific Modeling and Inference in Economics and Econometrics,* University of Chicago, 2000, p. 4.

out just one, or at any rate relatively few, as meriting serious attention.'[145] A further difficulty arises when choosing which method to make decisions with. Harold Jefferies lists his fundamental criteria for decision making as:

> **[S]cientific induction involves (1) observation and measurement and (2) generalization from past experience and data to explain the past and predict future outcomes.**

Bayes theorem has proved to be a popular choice for decision makers who prefer Jefferies reasoning. Charles Annis proposes that 'Bayesian thinking considers not only what the data have to say, but what your expertise tells you as well.'[146] Samuel Schmitt sums up the evaluation process,

> **'When we make our analysis we have at hand a probability distribution for the alternatives which expresses our accumulation of knowledge to that point. This is called the *prior distribution,* the one that comes *before* the observation or experiment [assessment]. Then we make an observation intended to tell us something about the relative merits of our alternatives. On the basis of this information we modify the prior probability distribution and obtain a new one, the *posterior distribution*, the one that comes *after* the observation. If we then have another experiment [assessment] to make, this posterior distribution becomes the prior distribution for the next step in the analysis. The words *prior* and *posterior* are relative words: they refer to the states before and after *any* observation.'[147]**

Bayesian methods have been applied to a wide range of theoretical and applied problems in many fields. The scope includes providing solutions involving estimation, prediction, testing, model selection and control.[148] A good example of Bayesian methods being used to solve a complex problem occurred during the first years of North Sea oil exploration,

> **'The first oil-drilling platforms in the North Sea were designed according to a minimax principle. In fact, they were supposed to resist the conjugate action of the worst gale and the worst storm ever observed, at the minimal record temperature. This strategy obviously gives a comfortable margin of safety but is quite costly. For more recent platforms,**

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[145] Howson, Colin and Urbach, Peter, *Scientific Reasoning: The Bayesian Approach,* Open Court, Chicago, 1993, p. 162.
[146] Annis, Charles, *Bayesian Thinking,* http://statisticalengineering.com/bayes_thinking.htm, (accessed 07/10/06).
[147] Schmitt, Samuel, *Measuring Uncertainty: An Elementary Introduction to Bayesian Statistics,* Addison-Wesley Publishing Company, London, 1969, p. 62.
[148] Zellner, Arnold, *op cit*, undated, p. 6.

engineers have taken into account the distribution of these weather phenomena in order to reduce the production cost.'[149]

Lawrence Philips points out though that social science based research will rely mainly on 'derived measurements with little underlying theory and few laws.'[150] Bayesian methods are able to compensate for this consideration and are still said to produce results 'as good as or better than those provided by other approaches, when they exist.'[151]

The philosophy is based on the idea that more may be known about a physical situation than is contained in the data from a single assessment or observation. The Bayesian approach also allows for combining results, or 'pooling information from different sources',[152] to update the prior state of knowledge on the subject being tested. The approach can also anticipate predispositions from people advancing pronounced theories that remain eccentric even with a large volume of data.[153] On the subject of data collection Robert Winkler argues

'[A]n important decision may involve uncertainty about a large number of events and may be of concern to quite a few people. For instance, some events may involve the stock market, in which case a financial analyst should be consulted; some of the events may involve sales of a certain product, in which case the sales and advertising managers should be consulted; and so on. The point is that a large-scale problem may involve many uncertainties, and numerous experts may be consulted regarding many uncertainties.[154]

Winkler does however concede that the eventual decision taken may not 'accurately reflect the preferences of each individual involved in the decision-making problem.'[155] Howson and Urbach argue that disregarding the data source, 'with all things being equal, the larger the apparent effect, the more decisive the inference.'[156]

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[149] Anon, *Bayesian Decision Theory,* http://userwww.sfsu.edu/~efc/classes/biol710/bayes/Decision_Theory.html (accessed 15/09/06).
[150] Derived measurements are related to the quantity being measured only through some law, for example temperature relates to height of the column of liquid through the operation of laws describing the expansion and contraction of liquids and solids brought about by changes in temperature. See Phillips, Lawrence D, *Bayesian Statistics for Social Scientists,* Nelson, London, 1973, p. 2.
[151] Zellner, Arnold, *op cit*, undated, p. 6.
[152] Morales, J-A, *Bayesian Full Information Structural Analysis,* Springer-Verlag, Berlin, 1971, p.1.
[153] Howson, Colin and Urbach, Peter, *op cit*, 1993, p. 381.
[154] Winkler, Henry, *Introduction to Bayesian Inference and Decision,* Holt, Rinehart and Winston, Inc, New York, 1972, p. 26.
[155] Winkler, Henry, *op cit*, 1972, p. 266.
[156] Howson, Colin and Urbach, Peter, *op cit*, 1993, p. 380.

In the long run consumers who endure short term disruptions in the Gulf, by default, widen their choice of producers afterwards. Unfortunately, in doing so they inadvertently add momentum to a disparaging conundrum. In Bayesian language the energy sector (*prior)*, rightly or wrongly, benefits from conflicts (*resulting in a posterior distribution)*. Given that so much oil and gas is to be found in conflict areas such as the Gulf, it is a sad fact that the energy sector will never be short of opportunities, some of which will unavoidably conflagrate into strife requiring international intervention. Bayesian analysis will show that Gulf supply disruptions have caused the energy sector to weep crocodile tears over a steady passing of *priors* and *posteriors* during the last thirty years. Without these disruptions however it is highly likely that the share price of most energy companies would be weaker than they currently are and consumers would have less choice and more to worry about in terms of security of supply than they do today. For the purposes of this thesis there is no better data analysis method available than Bayes given the problem to be solved.

Bayesian supply chain literature

A wide literature search for evidence of the Bayesian approach being applied to the oil industry failed to produce any specific research on supply chain risk. However, a paper by Valtorta et al provided some insight. The exercise involves utilizing theoretical data to construct a Bayesian network in order to model hypothetical attacks on pipelines in Iraq. Other examples range from adopting Bayesian analysis during wildcat drilling and oil spill management to calculating the degree of corrosion in pipelines.[157] The material was deemed inappropriate to model this thesis on. However, Paul Hewson's study on child accident prevention did offer better insight into how a Bayesian model for social science can be created. Hewson quotes the Department for Transport, Local Government and the Regions model for child accident rates as being:[158]

[157] Schuenemeyer, John H and Drew, Lawrence J, *Uncovering Influences on the Form of Oil and Gas Field Size Distributions,* Natural Resources Research, Vol. 8, No. 1, 1999. Pelizzari, Sonia and Dias, Jose M. Bioucas, *Bayesian Adaptive Oil Spill Segmentation of SAR Images via Graph Cuts,* Instituto de Telecomunicacoes, Lisboa. Ainouche, A, *Future Integrity Management Strategy of a Gas Pipeline Using Bayesian Risk Analysis,* 23rd World GAS Conference, Amsterdam, 2006.

[158] Hewson, Paul, *Child Pedestrian Accidents in the UK, Monitoring the UK Government's Road Safety Strategy,* Radical Statistics, No. 79, p. 8.

Time on Street *x* Degree of hazard presented by the environment

Ability to deal with risk

At a glance the model does appear to be quite straightforward and relatively simple. The text below explains how the in-depth analysis required for compiling the 'Ability to deal with risk' element was collated,

> **Johnson *et al*, (2001) reviewed a wide range of published studies examining individual proneness to road accident involvement over the last forty years. Potentially relevant social and psycho-social factors reviewed in this report that have been raised at some point include family size, birth order, female head of household, maternal education level, inability to speak English, indices of child stress or family stress, divorce or marital discord, physical or mental illness, poor or ineffectual child-rearing, atypical lifestyle, maternal pre-occupation (either through work or pregnancy). The list of factors reveals as much about government research prejudices over the last four decades as it does about factors which may have some bearing on child pedestrian accident rates, for example do the studies examining the mothers' role reflect on lower car ownership and driving by females or a more significant role in child-rearing. More recent work (Christoffel *et al*, 1996) suggested a number of specific factors, children with higher aggression, hyperactivity and anti-social behaviour ratings experienced greater risk, as did children from families with higher family stress and lower levels of family supportiveness and cohesion. This identifies children who may exhibit more risk-taking behaviour, but whether this associates with low socio-economic status or ethnic grouping is questionable…White *et al* (2000) have suggested that areas with high child pedestrian accident involvement tend to have low car ownership rates.[159]**

The material was used to produce the element's initial *prior distribution.* A similar approach to data research will be taken when analysing sudden events and discontinuities in this thesis.

[159] Hewson, Paul, *ibid*, p. 9-10.

Field Trip Summary

Introduction

On 14-16 November 2008 I attended the first Saudi Arabia Oil and Gas Exhibition (SAOGE) in Dammam, KSA. My aim was to interview company representatives about their views on the recent arrival of China as a supplier of goods and services to Aramco.

Ethical issues

The issue of ethics did present a problem that was overcome by anonymity. It became apparent, due to the 'sensitive nature' of the questions I proposed to ask that if I were to have a frank discussion on the subject any interviewees would have to remain anonymous.

Conducting the interviews

I decided to structure the interviews with a list of specific questions that would produce data relative to my enquiry and 'open' questions that would allow the interviewee to offer a personal and often more philosophical response. Once the five interviews were completed I was able to introduce 'overall perspective' to the subject by interviewing the Operations Manager (OM).

Results

I conducted five in depth interviews with representatives A, B, C, D and E. Reps A to D were all employed by US or European based Small/Medium Enterprises (SME). A summary of their answers can be found in the Field Trip annex at the end of the thesis. The full extent of the data in the table is presented later in Chapter 6.

Analysis

The field trip achieved the expected key objectives. The quality of the data gathered during the field trip was very high. The suppliers themselves were particularly open to my subject matter as the introduction of China into the oil field service sector was met by a degree of emotions ranging from scepticism to opportunity. The SME suppliers tended to view China as a threat to the long-term future of their product due to China's flagrant breach of copyright. This view changed among larger suppliers who saw China as a prospective partner, all be it a partner that would have to adhere to stricter quality control standards.

Conclusion

The SAOGE Exhibition was an excellent choice of venue to collect quality data. It would be very difficult to reciprocate the amount of choice and freely available knowledge available in any other setting. The only concession I had to make was to assure the anonymity of the reps I interviewed. I was assisted in my aims by the fact that I was gathering data that was of interest to the industry in general and on a topic that I did not hold a pre conceived bias.

Chapter 4

First Prior Distribution

In this chapter the chosen Bayesian methodology will be tested against a data set in order to produce a posterior distribution. The process is explained in the empirical stage of the research framework fig 4.1 below[160] where 'Design' is the prior distribution and 'Test hypotheses' is the posterior distribution.

Literature **Theory**
↓ ↓
Research area → Topic → Questions → Hypotheses → | Design → Data collection → Data analysis → Test hypotheses
↑
Context

Pre-empirical stage ***Empirical stage***

Fig 4.1 Research framework

Forming the first prior and posterior distribution

The factors by which it is possible to calculate a prior distribution of risks to the KSA oil supply chain are held in the equation, a modification of Hewson's example[161], below:

$$\frac{\text{Oil: Time in the supply chain } x \text{ Degree of hazard presented by the environment}}{\text{Ability to deal with risk}}$$

Below is a list of headings and sub headings for the chapter based on the above equation:

1. Oil: Time in the supply chain

[160] Punch, Keith F, *Introduction to Social Research Quantitative and Qualitative Approaches (Second Edition),* Sage, London, 2005, p. 40.
[161] Hewson, Paul, *Child Pedestrian Accidents in the UK, Monitoring the UK Government's Road Safety Strategy,* Radical Statistics, No. 79, p. 8.

2. Degree of hazard presented by the environment: Bayes theory and supply chain risk
   - Data collection
   - List of interviewees and perceived threats
   - Prior distribution risks
   - Prior distribution data table

3. Ability to deal with risk
   - Categorizing the risks
   - The scoring process and analysing the results
   - Prior distribution summary graph
   - Prior distribution threat table
   - Prior distribution summary
   - Forming a posterior distribution
   - Posterior distribution threat table

Oil supply chain

The thesis is primarily concerned with risks that could affect upstream and midstream operations of the KSA supply chain. The downstream element, from tanker to forecourt is seen as being more the responsibility of the importer.

In regard to Saudi Arabia's oil supply chain crude is pumped from the well through a network of pipelines to a tank storage farm from where it is exported by tanker through the Strait of Hormuz and onward for delivery to the importer. The oil may also pass through pipeline gathering systems, pumping stations, destabilizing plants which remove gasses from the crude and refineries, but in essence the logistics involve oil being pumped out of the ground (upstream), pipelines, storage, pumping on board a tanker and steaming out of the Gulf into the deep sea (midstream).

Saudi Aramco run the upstream and land based mid-stream element of the supply chain. This element is managed and maintained by a mixture of Saudi nationals, western ex-pat technicians and engineers, and migrant workers. Once the crude has been pumped on board a tanker the supply chain becomes the responsibility of the shipping industry.

Oil tankers are owned by individuals or form part of a fleet owned by a shipping company. All vessels are required to be registered to a state and fly the flag of the state to which the tanker is registered. The country to which the tanker is registered does not have to be the same state to which the owner is a citizen or resident. Tanker crews are generally hired from third world countries with a long tradition of supplying labour to the shipping industry.

Degree of hazard presented by the environment: Bayes theory and supply chain risk

It is worth being reminded of Harold Jefferies list of fundamental criteria for decision making:

> **[S]cientific induction involves (1) observation and measurement and (2) generalization from past experience and data to explain the past and predict future outcomes.**[162]

As discussed in detail in Chapter 2 previous disruptions to Gulf exports have been to various degrees caused by war, civil war, regime change, accidents or fiscal disagreements See table fig 4.2 below). Three predominate patterns, Jefferies 'generalization'[163], emerged, the double closure of the Suez Canal, war that targeted oil production and transportation and civil war that damaged infrastructure. In the case of war and civil war western owned oil field support services were also withdrawn.

[162] Zellner, Arnold, *Bayesian and Non-Baysian Approaches to Scientific Modeling and Inference in Economics and Econometrics,* University of Chicargo, Chicargo, p. 3.
[163] See above.

Date of oil supply disruption	Duration of supply disruption (in months)	Average gross supply shortfall (in MMBD)	Reason for oil supply disruption
3/51-10/54	44	0.7	Iranian oil fields nationalized
11/56-3/57	4	2	Suez War
12/66-3/67	3	0.7	Syrian transit tax dispute
6/67-8/67	2	2	Six Day War
5/70-1/71	9	0.8	Damage to Tapline
3/73-5/73	2	0.5	Unrest in Lebanon, damage to transit facilities
10/73-3/74	6	2.6	October Arab-Israeli War; Arab oil embargo
4/76-5/76	2	0.3	Lebanese Civil War, disruption to Iraqi exports
5/77-	1	0.7	Damage to Saudi oil fields
11/78-4/79	6	3..5	Iranian revolution
10/80-12/89	3	3..3	Iran-Iraq War
03/90-10/91	7	1	Kuwait oil well fires
09/11/01	-	-	World Trade Centre attacked
3/03-9/04	19	1	Iraq war and continued unrest

Fig 4.2 Table of Gulf oil disruptions 1951-1991

The 9/11 Al Qaeda terrorist attack on the World Trade Centre in 2001 introduced new threats to the region, about which there was little pre-existing data to refer to. Even the subsequent 2003 Iraq war differed in that Washington were implicit in regime change, as opposed to organizing a coupe by overtly removing Saddam Hussein from power and installing a new democratic government.

Previously during conflict Washington had chosen to back one side or another, ironically Iraq during the Iran-Iraq War, by way of political pressure, arms procurement and support services. Therefore in order to predict Jefferies 'future outcomes' as well as drawing from previous disruptions a new data set is required to form a 'prior

distribution' that incorporates possible post 9/11 threats to the oil supply chain. We can be reminded at this point of Samuel Schmitt's evaluation process:

> **'When we make our analysis we have at hand a probability distribution for the alternatives which expresses our accumulation of knowledge to that point. This is called the *prior distribution,* the one that comes *before* the observation or experiment [assessment].[164]**

In order to collect enough data to analyse and form a prior distribution with it was necessary to interview a number of willing participants on the subject of KSA oil supply chain security.

Data collection

In line with Bayesian methodology the scope and diversity of experts and the 'estimation, prediction, testing, model selection and control' within their comments would play a key role in determining an initial prior distribution. Winkler again:

> **'[A]n important decision may involve uncertainty about a large number of events and may be of concern to quite a few people. For instance, some events may involve the stock market, in which case a financial analyst should be consulted; some of the events may involve sales of a certain product, in which case the sales and advertising managers should be consulted; and so on. The point is that a large-scale problem may involve many uncertainties, and numerous experts may be consulted regarding many uncertainties.[165]**

In June 2008 seven interviews were conducted with experts. Where the interviewee wished to remain nameless the company or institution name has been substituted. Colin Howson and Peter Urbach argue that the decision making process is frustrated because scientists discriminate between possible explanations. They 'typically pick out just one, or at any rate relatively few, as meriting serious attention.'[166] For this reason not only scientists and academics were interviewed but also industry

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[164] Schmitt, Samuel, *Measuring Uncertainty: An Elementary Introduction to Bayesian Statistics,* Addison-Wesley Publishing Company, London, 1969, p. 62.
[165] Winkler, Henry, *Introduction to Bayesian Inference and Decision,* Holt, Rinehart and Winston, Inc, New York, 1972, p. 26.
[166] Howson, Colin and Urbach, Peter, *Scientific Reasoning: The Bayesian Approach,* Open Court, Chicago, 1993, p. 162.

specialists. Industry experts benefit from a 'working knowledge' as opposed to the structural approach attributed to scientists.

For the purposes of the data set the experts and the knowledge they held we classed as equal in merit, and each individual expert equal among the group. The interviewees were from diverse areas, academia, consultancy, industry and journalism therefore fulfilling Morales criteria of 'pooling information from different sources'.[167] The interviews were not recorded and any comment that appeared directly relevant to the KSA oil supply chain was noted, as was any comment that appeared seemingly irrelevant but provoked thought on the subject.

Selecting the experts

The experts for the first prior distribution questions were selected because of a combination of expertise, response to interview request, availability and their willingness to discuss issues around their subject of expertise.

The prior distribution required a significant number of possible risks and threats to the KSA oil supply chain. Initially a large number of experts were approached by email and directly by telephone. For various reasons, some were unable to become involved. The experts listed below responded positively to an interview request. During interview, they expressed fact based opinions about their own area of expertise and discussed at length contributing factors which should also be taken into consideration. The aim of the first prior distribution was therefore met in that the scope of threats included low, medium and high risks and threats to the KSA oil supply chain. The range of experts and their input effectively widened the data source. This would not have been possible or had the desired effect if the opinion of only a handful of single source experts were presented. The experts who were eventually chosen provided data which adequately met the criteria for a robust first prior distribution.

[167] Morales, J-A, *Bayesian Full Information Structural Analysis,* Springer-Verlag, Berlin, 1971, p.1.

List of interviewees and perceived threats

The seven interviews produced a total of sixty five comments listed below for analysis.

E.A. Gibson (Global oil tanker shipping company)

Gibson shipbroking service goes back over 115 years. Gibson chartering services to clients in over 90 countries with a leading presence in London, and offices in Houston, Hong Kong, China and Singapore. Gibson did not have a specific interest in the Saudi oil supply chain but as Saudi are a major exporter the reliability of oil for export is of interest to Gibson.

Mamoun Fandy (Fellow at the Institute of International Security Studies)

Dr Mamoun Fandy is an Egyptian-born American scholar. He is president of the think tank London Global Strategy Institute, a former senior fellow at the Baker Institute, the United States Institute of Peace, and at the International Institute for Strategic Studies in London. Before that Fandy was a research professor of politics at the Center for Contemporary Arab Studies at the School of Foreign Service of Georgetown University, as well as of Arab politics at the National Defense University. He is frequently seen on American television, and is a columnist for *Al-Ahram* and the *Asharq Al-Awsat*.

Dr David Glenn (Lecturer in Shipping at London Metropolitan University)

David Glenn was a lecturer in Shipping at London Metropolitan University specialising in oil tankers. Previously he worked for a chartering company in the oil tanker market.

Ted Hooton (Marine consultant)

E.R. (Ted) Hooton has been a journalist for 40 years and a defence journalist for about 25 years. Hooton is an expert on the tanker wars having co-written Navias, Martin S, and Hooton, E.R, *Tanker Wars: The Assault on Merchant Shipping During the Iran-Iraq Crisis, 1980-1988*, Tauris Academic Studies, London, 1996.

David Butter (Economist Middle East Expert)

David Butter was the regional director for the Middle East at the Economist Intelligence Unit, and prior to that worked for MEED magazine, where he was editor between 2000 and 2002. He holds an MA in comparative politics from Sussex University and a BA in Arabic and Persian from Oxford University. In 2013 Chatham House published his briefing paper on the political economy of Egypt.

Fred Halliday (London School of Economics – now deceased)

Fred Halliday was Professor of International Relations, in the Centre for the Study of Human Rights, at the London School of Economics and at the time of the interview was visiting professor at CIDOB, Barcelona, for 2004-05. Halliday was a former chairman of the Research Committee of the Royal Institute of International Affairs and was on the Advisory Council of the Foreign Policy Centre. Halliday was scholar and activist who has profound knowledge of the Middle East.

Centre for Global Energy Studies

Founded in 1990 by Sheikh Ahmed Zaki Yamani, the Centre for Global Energy Studies (CGES) is a non-profit think tank, specialising in oil market analysis and forecasting, and the economics and politics of energy. CGES expertise lies in oil price movements, the futures market, OPEC policy, oil and gas demand and supply, geopolitics of the Middle East, the FSU and West Africa. CGES offer advice and consultancy, publish oil market reports and hold regular energy-related events.

Interview questions

No	Expert	Threat	Interpretation	Justification	Status
1	Butter	Robust dependable supply chain is an unfortunate contribution to continuing unrest in the M/E[168]	*If the supply chain were to be heavily disrupted how would the US be affected by a drop in supply?*	US will remain dominant in Gulf security	Ongoing

[168] Jones C, Toby, *America, oil, and war in the Middle East,* The Journal of American History, http://jah.oxfordjournals.org/content/99/1/208.full

2	Glenn	IMO-tried to improve crew training.[169]	*Will crew issues affect supply?*	Traditional methods of crewing and recruitment may be challenged	Ongoing
3	Glenn	ISPS-caused tension among crews and nationalities.[170]	*An ongoing issue regardless of tanker design.*	Traditional methods of crewing and recruitment may be challenged	Ongoing
4	Halliday	Limburg-insurance levels-attack to destabilize Yemen (Halliday)[171].	*A similar event could occur originating from a Gulf State.*	Increased insurance as damaging as physical damage	Ongoing
5	Butter	Iraq pipeline damage a 'carefully calibrated scam' (Butter)[172].	*Attack(s) on pipelines*	Attacks on pipelines appear worse than they really are?	Ongoing
6	Butter	Al-Qaeda damaging to Saudi-ex-pats leaving[173].	*Shortage of qualified engineers*	Terrorism causes intellectual as well as physical damage	Ongoing
7	Hooton	Overlooked point-USA is an 18th Century nation-said to want power but not be responsible for it[174].	*Continued policy friction*	US does not always intervene[175]	Ongoing
8	Hooton	M/E Policy deeply religiously motivated[176]	How will Sunni and Shia live side by side?	Non-political conflict difficult to politically manage	Ongoing
9	Hooton	Christian fundamentalists in USA driving policy towards Israel[177].	*US enacts a policy which becomes detrimental to production*	US Foreign Policy tries to please domestic voters	Ongoing
10	Hooton	Saudi/Islamic society in M/E Gulf difficult to adapt[178]	*Will the Gulf states adapt to a Sunni/Shia divide?*	Level of conflict between Shi/Sunni communities unknown	Ongoing

[169] Perez, Jose, Manuel, Diaz, *The IMO Standard Communication Phrases*, IMO, http://www.imla.co/imec/SMCP%20history.pdf
[170] Balbaa, Alsnosy, *Protecting seafarer's rights – The need to review the implementation of the ISPS code*, Nautical Department, College of Maritime Transport and Technology Arab Academy for Science, Technology and Maritime Transport, Alexandria, Egypt, http://iamu-edu.org/wp-content/uploads/2014/07/s2-balbaa.pdf
[171] Smith, Craig S, *Fire on French Tanker off Yemen Raises Terrorism Fears,* New York Times, 07/10/2002, http://www.nytimes.com/2002/10/07/world/fire-on-french-tanker-off-yemen-raises-terrorism-fears.html
[172] David Butter's personal opinion.
[173] MacAskill, Ewan, *Danger money for expats as the Saudi exodus grows,* The Guardian, London, 24/06/2004, https://www.theguardian.com/world/2004/jun/24/alqaida.saudiarabia
[174] Ted Hooton's personal opinion.
[175] For example in the Suez crisis.
[176] Casertano, Stefano, *Delayer in Chief,* The European, 13/06/2013, http://www.theeuropean-magazine.com/stefano-casertano--3/7022-us-policy-in-the-middle-east
[177] Monboit, George, *US Christian fundamentalists are driving Bush's Middle East policy,* The Guardian, London, 20/04/2014, https://www.theguardian.com/world/2004/apr/20/usa.uselections2004
[178] Anon, *Adapt or die,* Economist, London, 04/03/2004, http://www.economist.com/node/2482168

11	Hooton	Religious decrees are state policy[179]	*Will Gulf state policy result in friction?*	Saudi policies often clash with US policies	Ongoing
12	Hooton	Cannot adjust-spoken work-illiteracy[180].	*Potential terrorists easier to influence and recruit*	Potential rise in terrorism	Ongoing
13	Hooton	No Arab states (except Egypt) have the infrastructure to build weapons or capability to destroy Israel[181].	*If this changes will it be easier for terrorists to procure arms?*	Regardless the US take Iranian threats seriously	Ongoing
14	Hooton	Naval operations in the Gulf are marred by a 30 metre haze on the surface of the sea[182]	*How would this affect a future closure of the Strait of Hormuz?*	Conflict in the Gulf stretch the armed forces	Ongoing
15	Hooton	Iran cannot protect itself[183]	*Would Iran therefore not attempt to disrupt supply?*	Regardless the US take Iranian threats seriously	Ongoing
16	Glenn	Saudi reserves higher now than in the 70's[184]	*The reserves may be higher but is the technology available to extract the oil?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
17	Butter	Oil marker works on the Dollar[185]	*Do the Iranians resent this?*	Regardless the US take Iranian threats seriously	Ongoing
18	Glenn	Past behaviour – OPEC on full power – market share of M/E oil fell dramatically[186]	*Could OPEC compensate for a major M/E disruption?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
19	Glenn	Production 'peaks' are local and field based – not global[187]	*Can western technology continue to extract oil in time with demand?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
20	Glenn	Shipping reactive not 'in anticipation'[188]	*Will shipping react quickly enough to prevent losses in a combat situation?*	Technical risk to tankers unknown	Ongoing
21	Glenn	'Prestige' accelerated phase in	*Will double hull tankers be easier to sink/disable than single hull tankers?*	Technical risk to tankers unknown	Ongoing

[179] Ayoob, Mohammed, Kosebalaban, Hasan (eds), *Religion and Politics in Saudi Arabia – Wahhabism and the State,* Lynne Riennes Publishing, Boulder, Colorado, 30/01/2009.
[180] Saudi has taken significant steps to raise the level of literacy in the Kingdom. See, Anon, *Kingdom achieves 96% literacy rate,* Arab News, 10/09/2013, http://www.arabnews.com/news/464118
[181] Ted Hooton's personal opinion.
[182] Navias, Martin S, and Hooton, E.R, *Tanker Wars: The Assault on Merchant Shipping During the Iran-Iraq Crisis, 1980-1988*, Tauris Academic Studies, London, 1996, p.85.
[183] Ted Hooton's personal opinion widely shared by other commentators.
[184] Fattouh, Bassam, Sen, Anupama, *Saudi Arabian Oil Policy: More than meets the eye?,* Oxford Institute for Energy Studies, Oxford, 06/2015, p. 8.
[185] Ellyatt, Holly, *Will Saudi Arabia now abandon its dollar peg?* CNBC, 29/12/2015, http://www.cnbc.com/2015/12/29/will-saudi-arabia-now-abandon-its-dollar-peg.html
[186] David Glenn's personal opinion.
[187] Jackson, James S, *Global and Local Peaks in Oil and Gas Production,* Portland State University, Portland, Oregon.
[188] David Glenn's personal observation.

		of double hull by 5 years[189]			
22	Glenn	IMO-minimize impact on owners who have got it in hand[190]	*Will owners refuse to send new double hull tankers into a terrorist area?*	Technical risk to tankers unknown	Ongoing
23	Glenn	Titanic triggered SOLAS	*SOLAS was reactionary. Will there be a reactionary action to double hull tankers if they are susceptible to terrorist damage?*[191]	Technical risk to tankers unknown	Ongoing
24	Glenn	'Herald of Free Enterprise' and 'Estonia' moved regulation forward	*If double hull tankers move regulation forward will the regulation impact on their ability to steam in the Gulf?*[192]	Technical risk to tankers unknown	Ongoing
25	Butter	Algeria-little disruption during civil conflict[193]	*Will the opposite prove true in the Gulf?*	Regardless the US take Iranian threats seriously	Ongoing
26	Glenn	Technology driven industry can increase/develop extraction[194]	*Will Western technology endure?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
27	Glenn	Club of Rome (ceased in 1995) did not allow for technical revolutions[195]	*Will other predictions omit important factors?*	Technical risk to tankers unknown	Ongoing
28	Butter	Production risks added to supply risks[196]	*Will disruptions occur through conflict or technical failures?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
29	Glenn	Current high price maybe due to low refining capacity[197]	*Are refineries the key target for disruptions*	Can Saudi Spare Production Capacity meet demand?	Ongoing
30	Butter	No real M/E leadership figure[198]	*If a leader were to emerge, would they restrict supply?*	Regardless the US take Iranian threats seriously	Ongoing

[189] OECD, *Impact of International Safety and Environmental Regulation on the Shipbuilding Industry,* 18/12/2006.
[190] David Glenn's personal opinion
[191] Rynn, Philip G, *Structural Defects on Double Hull Tankers,* American Bureau of Shipping.
[192] Rynn, Philip G, *Ibid*
[193] Glasser, Charles L, Kelanic, Rosemary A, *Crude Strategy: Rethinking the US Military Commitment to Defend Persian Gulf Oil,* Georgetown University Press, Georgetown, 12/07/2016, p. 131.
[194] Anon, *Oil and Gas Technology Development,* National Petroleum Council, 18/07/2007.
[195] David Glenn's personal opinion.
[196] Raval, Anjili, *Oil Investors bet on Future Supply Risks,* Financial Times, London, 21/07/2014, https://www.ft.com/content/7c9cf8b2-2909-11e4-9d5d-00144feabdc0
[197] David Glenn;s personal opinion.
[198] David Butter's personal opinion.

31	Glenn	Few State owned/private players[199]	*Narrow industry decision making*	Will western technology endure?	Ongoing
32	E.A. Gibson	Attack on Limburg thought to be an internal explosion which worried insurance companies. Said to be a relief that the blast was caused by terrorists[200]	*Internal explosion could potentially affect every double hull tanker. Terrorism only affects the targeted tanker*	Technical risk to tankers unknown	Ongoing
33	Glenn	Forward projections too assuming[201]	*Assumption is based on free flow of exports*	Can Saudi Spare Production Capacity meet demand?	Current
34	Hooton	Iran's nuclear ambition is a statement[202]	*Doubt over Iran's capability to develop nuclear power and/or weapons*	Regardless the US take Iranian threats seriously	Current
35	Hooton	Iran's nuclear program is a threat reduction exercise[203]	*At what point will Iran's nuclear program be considered too big a risk to destroy by hostile forces*	Regardless the US take Iranian threats seriously	Current
36	Butter	Iranian decision making process difficult-Mullahs have overruled the President[204]	*Will Iran decide to block the Strait of Hormuz?*	Regardless the US take Iranian threats seriously	Current
37	Butter	US dependency on M/E oil overstated in political debate[205]	*Just how important will spare production capacity be in the future?*	Can Saudi Spare Production Capacity meet demand?	Current
38	Butter	Iran-adverse pressure has depressed production (4MMBD for next 5 years[206]	*Will any adverse pressure be applied to any of the Gulf States? If so, will the pressure reduce production?*	Can Saudi Spare Production Capacity meet demand?	Current
39	Butter	Iranian gas projects suffered as a result of nuclear program and internal politics[207]	*How much will the Gulf States invest in future projects?*	Will western technology endure?	Current

[199] Dlouhy, Jennifer A, *Big Oil's Footprint in Washington Shrinks with the Price of oil,* Bloomberg, 08/06/2014, http://www.bloomberg.com/news/articles/2016-06-08/big-oil-s-footprint-in-washington-shrinks-with-price-of-crude
[200] E.A, Gibson personal observation.
[201] Fattouh, Bassam, *The Drivers of Oil Prices,* SOAS, London, 03/2007.
[202] Ted Hooton's personal opinion
[203] Ted Hooton's personal opinion
[204] Choksy, Jamsheed K, *Tehran Politics: Are the Mullahs Losing their Grip?* World Affairs, 05/2012, http://www.worldaffairsjournal.org/article/tehran-politics-are-mullahs-losing-their-grip
[205] Tisdall, Simon, *Saudi Arabia and the West: how a cosy relationship turned toxic,* The Guardian, London, 27/01/2015, https://www.theguardian.com/world/2015/jan/27/saudi-arabia-and-the-west-how-cosy-relationship-turned-toxic
[206] David Butter's personal opinion
[207] David Butter's personal opinion

40	CGES	Iranian agricultural industry returns as much to GDP as the oil industry[208]	*Belief that Iran depends on oil alone*	Regardless the US take Iranian threats seriously	Current
41	E.A. Gibson	Shell proven reserves crisis motivated interest in the industry as well as 9/11.[209]	*Are Iran's proven reserves accurate?*	Regardless the US take Iranian threats seriously	Current
42	Fandy	Re-flagging-Between communities-Shia flag/Sunni flag?[210]	*Will the widening Sunni/Shia divide affect supply?*	Will Iran influence the Shia/Sunni conflict?	Current
43	Hooton	Any attempt to mine the Straits of Hormuz would attract international retaliation[211]	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current
44	E.A. Gibson	Saudi's building 3 refineries in the Gulf[212]	*Increased traffic of finished product.*	Increases tanker traffic	Emerging
45	Glenn	2010 double-hull phase in complete[213]	*Tanker industry struggling to adapt to change in legislation.*	Technical risk to tankers unknown	Emerging
46	E.A. Gibson	Shortage of tankers for a 'shuttle service'[214]	*Oil industry would have to rethink previous arrangements for exporting oil from the Gulf during conflict.*	Conflict in the Gulf stretch the armed forces	Emerging
47	Glenn	If safer fields are found and commercially viable deposits become exploited the interest in M/E oil may fall[215]	*Gulf security may fall as interest shifts elsewhere*	Fall in Gulf security	Future
48	Hooton	The planned Iranian Bourse?[216]	*Which currency would the Bourse trade in? And if it were not the dollar*	Increased sanctions against Iran	Future

[208] CGES personal observation
[209] Donovan, John, *9/11 Terror Attack and the Shell Reserves Scandal,* 05/02/2013, http://royaldutchshellplc.com/2013/02/05/59955/
[210] Mamoun Fandy's personal opinion.
[211] See Chaper 6,
[212] El Gamal, Rania, *Saudi Arabia adds to oil power with new Refineries,* Reuters, 04/11/2014, http://uk.reuters.com/article/saudi-oil-refineries-idUSL5N0SQ3UH20141104
[213] IMO, *Construction Requirements for Oil Tankers – Double Hulls,* http://www.imo.org/en/OurWork/Environment/PollutionPrevention/OilPollution/Pages/constructionrequirements.aspx
[214] E.A. Gibson personal opinion
[215] Thompson, Loren, *What Happens When America No Longer Needs Middle East Oil?* Forbes, 03/12/2012, http://www.forbes.com/sites/lorenthompson/2012/12/03/what-happens-when-america-no-longer-needs-middle-east-oil/#5a5cb22264fa
[216] Whitney, Mike, *Iran's Oil Bourse Could Topple the Dollar,* 02/05/2008, http://www.rense.com/general80/topple.htm

			then how would the US react		
49	Glenn	There may not be enough UK seafarers to call on in the event of an emergency[217]	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future
50	Glenn	Meeting of Commodores in 1996-Crisis if number of Officers fell below 10,000 (Glenn).[218]	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future
51	Glenn	Age profile-diminish-who replaces them-Indian seafarers retire at 50 (made money by then)[219]	*Could long term crewing problems affect supply?*	Conflict in the Gulf stretch the armed forces	Future
52	Hooton	Japan-no foreign military experience[220]	*Major Gulf oil customers may not be deployed to defend their interests*	Conflict in the Gulf stretch the armed forces	Future
53	Hooton	Japan-constitutional problems in sending troops abroad[221]	*Major Gulf oil customers may not be deployed to defend their interests*	Conflict in the Gulf stretch the armed forces	Future
54	Hooton	Is China capable of defending the Gulf?[222]	*Questionable foreign involvement too risky to rely on.*	Conflict in the Gulf stretch the armed forces	Future
55	Hooton	How much religious 'feeling' remains after Iraq war?[223]	*Level of future unrest unknown*	Potential rise in terrorism	Future
56	Hooton	How will the affected generation grow up?[224]	*Level of future unrest unknown*	Potential rise in terrorism	Future
57	Hooton	Iranian attack on Jerusalem unlikely-Iranians are not	*If Iran were to attack Israel would this act affect supply?*	Regardless the US take Iranian threats seriously	Future

[217] David Glenn's personal opinion
[218] David Glenn's personal opinion
[219] David Glenn's personal observation
[220] Teslik, Lee Hudson, *Japan and it's Military,* Council on Foreign Relations, Washington D.C, 13/04/2006.
[221] Teslik, Lee Hudson, *Ibid*
[222] Douglas, John Keefer, *How China's Energy Demands are Transforming the Middle East,* Tufts University, Medford, Spring 2007, p. 7.
[223] Lipka, Michael, *The Sunni-Shia Divide: Where they live, what they believe and how they view each other,* Pew Research Centre, 18/06/2014, http://www.pewresearch.org/fact-tank/2014/06/18/the-sunni-shia-divide-where-they-live-what-they-believe-and-how-they-view-each-other/
[224] Howard, Michael, *Children of War: the generation traumatised by violence in Iraq,* The Guardian, London, 06/02/2007, https://www.theguardian.com/world/2007/feb/06/iraq.topstories3

		Jews, Arabs or Christians[225]			
58	Hooton	Mine's in shallow waters only, in the deep middle the current is too strong[226]	*Shipping lanes may not be mined*	Technical risk to tankers unknown	Future
59	Hooton	Submarines-greatest threat[227]	*How far do Iran's capabilities extend?*	Conflict in the Gulf stretch the armed forces	Future
60	Hooton	Anti-sub ships-India, Pakistan and China would join in[228]	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
61	Hooton	Russia would join in for the money[229]	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
62	Hooton	May result in convoys of tankers[230]	*Conflict in the Strait of Hormuz would present a crisis situation.*	Conflict in the Gulf stretch the armed forces	Future
63	Hooton	Anti-ship missiles can be detected[231]	*Detection technology has improved since the tanker war.*	Technical risk to tankers unknown	Future
64	Hooton	Missile technology has not been directed at tankers-propulsion and guidance development not warhead[232]	*Weapons directed at oil tankers have not changed since the tanker war.*	Technical risk to tankers unknown	Future
65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency[233]	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

[225] Rafizadeh, Majid, *Will Iran attack Israel?* Al Arabya, 05/07/2016, http://english.alarabiya.net/en/views/news/middle-east/2016/08/05/Will-Iran-attack-Israel-.html
[226] Khan, Sabahat, *Iranian Mining of the Strait of Hormuz: Plausibility and Key Considerations,* Institute for Near East and Gulf Military Analysis, 01/2010, http://www.inegma.com/Admin/Content/File-29122013113155.pdf
[227] Ted Hooton's personal opinion
[228] Agence France Press, *Iran Stages Military Exercises in the Strait of Hormuz,* 25/02/2016, http://www.defensenews.com/story/defense/international/mideast-africa/2015/02/25/iran-stages-military-exercises-strait-hormuz/24025383/
[229] Agence France Press, *Ibid*
[230] Ted Hooton's personal opinion
[231] Ted Hooton reiterates a common defence understanding
[232] Ted Hooton's personal observation
[233] David Glenn's personal observation

Although not an authority on the subject there is one further although wider reference to the degree of hazard presented by the environment in the 2006 Centre for Energy, Petroleum, Mineral Law and Policy (CEPMLP) report entitled 'Security of International Oil and Gas: Challenges and Research Priorities'. The report provides table 4.3 below[234] which states the perceived vulnerability to the supply chain at a global scale.

Table 1a. Security of supply for oil: summary of vulnerability over the long-term at a global scale

	LOW IMPACT		MEDIUM IMPACT		HIGH IMPACT	
	Short-term	**Long-term**	**Short-term**	**Long-term**	**Short-term**	**Long-term**
HIGH PROBABILITY	Natural event Accident Terrorist event Piracy Industrial action		Repeated natural events Major accident Reduction of exports from single major exporter			
MEDIUM PROBABILITY			Major terrorist event Oil demand surge	Endemic terrorism or piracy Prolonged cessation of exports from single major exporter Prolonged oil demand surge	Reduction of exports from several major exporters	Prolonged reduction of exports from several major exporters. Inadequate investment.
LOW PROBABILITY					Cessation of exports from several major exporters	Prolonged cessation of exports from several major exporters

Fig 4.3 Vulnerability to the global oil supply chain[235]

[234] Centre for Energy, Petroleum and Mineral Law and Policy, *Security of International Oil and Gas: Challenges and Research Priorities: A Project for the Economic and Social Research Council.* CEPMLP, Dundee, 2006, p.11.

[235] Centre for Energy, Petroleum and Mineral Law and Policy, *Security of International Oil and Gas: Challenges and Research Priorities: A Project for the Economic and Social Research Council.* CEPMLP, Dundee, 2006, p.11.

The data obtained from the interviews combined with the degree of risk displayed in the above table will greatly assist in forming a prior distribution. A further point to consider is whether the validity of the issues that form the prior distribution are relevant to the overall question of supply chain risk. O. D. Duncan argues that:

> **'All measurement…is social measurement. Physical measures are made for social purposes…their origins seem to represent attempts to meet every day human needs, not merely experiments [assessment] undertaken to satisfy scientific curiosity.'**[236]

In this context it is appropriate that the prior distribution consists of issues measured from a social standpoint, regardless of whether the issue at question is of a physical nature. The specific task of forming the prior distribution concerning risk to the KSA oil supply chain will be drawn from data held in the historical analysis, interview questions, vulnerability table above and current relevant literature. In effect this is the 'Oil: Time in the supply chain *x* Degree of hazard presented by the environment' element of Hewson's equation.

So as to test the methodology against the data, eight potential areas of risk will be tested. These risk areas will be split into four categories. The four categories, politics, supply, technology and demographics represent the social, industrial, technological and cultural economy of the Gulf region. The eight areas of risk or 'issues' that form the prior distribution are listed under their category below along with an explanation as to why they were chosen.

<u>Prior distribution risks</u>

- ***Politics***

    1. **Boundary disputes**

    Boundary disputes have been a continuing cause of disruptions to the Gulf oil supply. The closure of the Suez Canal in 1956 and 1967, the Iran-Iraq War and

[236] DeVellis, Robert F, *Scale Development: theory and Applications, Second Edition,* SAGE Publications, London, 2003.

1991 Kuwait war all involved conflict over borders. Halliday stated that boundary disputes could be a contributing factor towards future disruptions.

2. Saudi instability

Post 9/11 the issue of terrorism in Saudi Arabia was an unknown quantity. However, NATO placed the possibility of escalating terrorism high on the agenda regarding the future security of Saudi Arabia. The introduction of terrorism is a discontinuation of the relative peace that was previously afforded to the Kingdom. Of the interviewees E.A Gibson, Hooton, Butter and Halliday all state terrorism as being a factor for current and future consideration. CEPMLP also warn on a global scale that terrorism could be responsible for future short term low or long term medium disruptions. Ever since 9/11 Terrorism has generally been considered to be a threat that will intensify. With this in mind the inclusion of terrorism as a threat to the KSA is viewed as a key addition.

3. Iran at a geopolitical premium.

David Butter pressed this key point at interview. Ever since 1979 Iran has been a threat to Gulf oil producing States. During the Iran-Iraq War Tehran repeatedly threatened to close the Strait of Hormuz and targeted oil tankers carrying crude from exporting States. Iran's potential has increased with the continual development of Tehran's nuclear programme. Tanker traffic through the Straits of Hormuz is projected to rise from the current level of 14 million barrels a day (MMBD) to 42 MMBD by 2020, a relative increase from 14 to 42 Very Large Crude Carriers per day.[237] Since 9/11 however, the Gulf region has been of particular concern. Iran has recently posted anti-ship missiles at both entrances to the Straits.[238] Iran's ongoing nuclear programme may also have the potential to cause major supply disruptions in the future. These threats pose the question of whether or not sea lanes through the Straits of Hormuz

[237] Cordesman, Anthony, *op cit*, 2004, p. 92.
[238] Klare, Michael, *op cit*, 2004, p. 108.

need to be protected.[239] Indeed, Michael Klare calls for the 'establishment of a multilateral oil tanker escort fleet'[240] to aid the so far unimpeded export of Gulf crude. Iran also featured highly in comments from all interviewees. The perceived threats however range from improbable to highly likely. Due to Iran's geopolitical position and Tehran's conflicting decision making process, previous threats have often been benign. This position could change if Tehran manages to gain political leverage through Iran's nuclear program. The expectation is therefore that assessing the threats will highlight exactly where Iran's geopolitical premium lies.

- ***Supply***

4. US-Saudi oil dependency overstated, most oil going to the East.

David Butter and David Glenn provided this insightful question during interview. The issue of overstated US dependency on Saudi oil opens a debate as to whether Washington would continue to intervene, as it did in Kuwait, during a sizable disruption or not. Rather than simply be a question of supply and demand, the threat posed is one of changing spheres of interest. The position taken in the study hinges on how important an unimpeded flow of oil is to the market as opposed to America relying on Saudi oil.

5. Lack of spare production capacity (SPC).

Saudi Arabia holds the unique position of being able to regulate production to meet demand. In the past the Kingdom's SPC has prevented the oil price from rising and in doing so stabilized the economies of major importers. The question arises as to whether post 9/11 threats could cause a further decline in SPC. The actual production of oil relies on the infrastructure whereas the decision to regulate production is political. The inclusion of SPC covers both physical and political threats. There is also the shipping of oil to take into consideration. The

[239] Caruso, Guy F, *op cit*.
[240] Klare, Michael, *op cit*, 2004, p. 192.

range and scope of perceived threats to KSA SPC is potentially high and encompass threats mentioned by all the interviewees. For this reason only realistic threats will be pursued. Improbable and inconceivable threats will be discounted. The overall expectation is that any perceived threats to SPC may be absorbed into other more appropriate risk factors in the further study.

- ***Technology***

6. Double Hulled tankers.

The discontinuation of single hull tankers over to the continuation of double hull tankers deserves investigation. There is a gap in academic literature regarding this comparison. Although E.A. Gibson, Hooton and Halliday advance threats directed at oil tankers, collectively they, as well as existing literature, do not offer an opinion regarding the impact and consequence between single and double hull tankers.

Historically the Iran-Iraq War proved to be the greatest threat to tanker traffic. Iraq tried unsuccessfully to stop foreign tankers from loading Iranian oil. Between 1982 and 1986 one hundred and sixty one tankers were damaged during the 'tanker war' killing over one hundred crewmen.[241] The tankers were mainly hit from the air by rockets or Exocet missiles. All the vessels involved were insured, even those damaged without a cargo bill of laden received compensation. Several of the vessels were declared total losses, but by way of a testimony to their resilience only a few sank completely. The Saudi flagged *Safina-Al-Arab* for example suffered a 240 square foot hole in the starboard side but managed to stay afloat.[242] Double hull tankers had not been introduced at the time of the Iran-Iraq War. Single hull tankers were hit and damaged. Under similar circumstances how would double hull tankers fare?

[241] Hooton, B.R, Navias, Martin S, *Tanker Wars,* Tauris, 1996, p.2.

[242] http://csis.org/files/media/csis/pubs/9005lessonsiraniraqii-chap14.pdf

7. **Western technology.**

The US and Europe have provided oil field services and expertise ever since the discovery of oil in the region. However after 9/11 Washington placed Saudi Arabia under suspicion, at the same time as China's economic rise. This poses the question of China's future involvement in Saudi oil field technology, a discontinuation of previous US and European dominance in the area. Of the interviewees Glenn, Hooton and Butter expressed a view that technology could pose a threat to production. Therefore the issue of technology cannot be ignored. Not discounting the interviewees the key area of oil field technology is particularly underrepresented in academic literature focusing on energy security.

- ***Demography***

8. **Sunni/Shia divide**

Mamoun Fandy advanced the Sunni/Shia divide as a perceived threat. The interviews were conducted before the advent of the 'Arab Spring' revolutions so although the topic was not at its peak the inclusion of this factor is fortunate. However due to the timing of the study and for that matter the CEPMLP data regarding the Sunni/Shia divide was less than complete. For this reason it is important to note that a low overall threat rating does not discount the risk factor if the available data to score the threat rating is incomplete or emerging.

	Environment	Risk	Status	Expected likelihood
1	Political	Boundary disputes	Continuation	Medium
2	Political	Saudi instability	Discontinuation	?
3	Political	Iranians at a geopolitical premium	Continuation/Discontinuation (nuclear programme)	?
4	Supply	US-Saudi oil dependency overstated	Continuation	Low
5	Supply	Lack of spare production capacity	Continuation	Low
6	Technology	Double hull tankers	Discontinuation	?
7	Technology	Western technology	Discontinuation	?
8	Demography	Shia/Sunni divide	Discontinuation	?

Fig 4.4 Prior distribution data table

When placed in tabulated form the prior distribution is split between continuities and discontinuities, although Iran holds both. Taking into account historical data the possibility of the issues causing a disruption ranges from low to high but with five unknown quantities due to lack of data, or in the case of the Shia/Sunni divide the issue was quickly gaining momentum.

Ability to deal with risk: calculating a posterior distribution

Following Samuel Schmitt's explanation, the prior distribution will be tested to form a 'posterior' distribution:

> **[W]e [then] make an observation intended to tell us something about the relative merits of our alternatives. On the basis of this information we modify the prior probability distribution and obtain a new one, the *posterior distribution*, the one that comes *after* the observation. If we then have another experiment [assessment] to make, this posterior distribution becomes the prior distribution for the next step in the analysis. The words**

***prior* and *posterior* are relative words: they refer to the states before and after *any* observation.'**[243]

Before the sixty five interview comments were applied to the eight issues that formed the prior distribution to produce a posterior distribution they were split into four risk categories, ongoing, current, emerging and future risks (see list below). Splitting the results into the four categories will assist in assessing a timescale in relation to the individual risks.

The scoring process

When plotting the graphs or 'observation' the impact, consequence and probability to a supply disruption was applied to all sixty five comments provided by the interviewees. Bayes theory does not favour one form of measurement over another. The measurement can be qualitative or quantitative or a combination of both. What is important is that the factor being measured is measured against an appropriate indicator relevant to the factor and an appropriate scale.

Threat factors were scored out of 10 against each of their perceived indicators of impact, consequence and probability – scoring a possible total of 30 per individual threat. The scores are perceived scores. They are scored based on a general posture. Due to the amount of data being collected, if a comment is misinterpreted and an incorrect or unrealistic score applied, then this score alone is unlikely to effect the overall distribution enough to corrupt the outcome. The aim of plotting the graphs is to calculate risk – all threats considered.

Consideration also includes taking into account that all the threats (factors) are unlikely to happen simultaneously and be universally successful in their impact (variable) and consequence (variable). In order to calculate overall possibility (variable) of a threat realistically materializing a 'likelihood' of low, medium and high was also applied to the threat. The likelihood is based on historical data patterns, current literature and reasoning that if the threat were to be executed, the executor would expect to field the

[243] Schmitt, Samuel, *Measuring Uncertainty: An Elementary Introduction to Bayesian Statistics,* Addison-Wesley Publishing Company, London, 1969, p. 62.

consequences. Overall the likelihood is based on the distinct and conceivable possibility of the threat occurring should circumstances arise, as opposed to the probability of multiple threats, however realistic, remote or implied, being advanced. The likelihood acts as a 'plausibility' filter to the probability variables through which realistic threats are sorted from the unrealistic ones.

The probability (of the disruption happening) is scored on the probability of the conditions required for the impact to occur as stated in the comment. For example it may be held that an event could occur such as a meteor strike that impacts on supply, the consequence of which would be devastating but the probability of the circumstances causing the initial impact will only occur if there is a certainty the meteorite will hit a target that could affect supply. The likelihood is that a meteor will strike earth, as they do occasionally, but a meteor will not be big enough, because historically they tend to be small, to cause substantial damage or fall on its intended target. The likelihood therefore of a meteor affecting supply is extremely low but not non-existent, as small meteors do hit earth occasionally. Conversely, the failure of a seal in a pipeline joint will have a very low impact on supply. The consequences of replacing the seal will shut off supply for a very short time but the probability of a failure of this kind is far higher than a meteor strike because such failures are well documented. The circumstances surrounding such an event are likely to reoccur but production takes theses failures into account, however the likelihood remains high for this type of disruption to be an ongoing risk.

The case for separating the probability of a threat from occurring as opposed to the likelihood of a threat happening is to deter the inclusion of implied threats. Implied threats may sound plausible but on reflection the likelihood of them ever being assembled is low enough for the threat to be discounted. For example, the impact of a nail in a car tyre may only deflate the tyre, which can be repaired. The consequence however may be that the driver misses a plane to an important meeting. The probability of running over a nail and missing a flight depend largely on how often the car driver travels to the airport to catch a flight (the 'event'). If the driver undertakes this task once a year then the likelihood of a nail causing a flat tyre is low but the likelihood rises if the driver increases the events (frequency they drive to the airport) under which the circumstances above could arise. Therefore, the impact,

consequence and probability may theoretically exist but may only occur if the event is likely to take place. In other words, a nail can puncture a car tyre during any journey but a driver will only miss a flight if the tyre bursts on the way to the airport.

A deeper analysis of the treats took place than in the example above. Just as Hewson examines a multitude of factors to calculate car accidents such as speed, visibility, road surface[244] etc. this study benefited from the list of perceived threats put forward by experts. During the scoring process threats that relied on improbable events in order to succeed were discounted in the final analysis of the graph. The key data in every graph is broken down into tabulated form at the end of the analysis.

As will be apparent from the analysis the scoring of the comments did not take place at face value. If the comment had no merit but did provoke or prompt thought when viewed in a different context it was the reconstituted comment that was scored (see fig 4.5 'Scoring methodology' below).

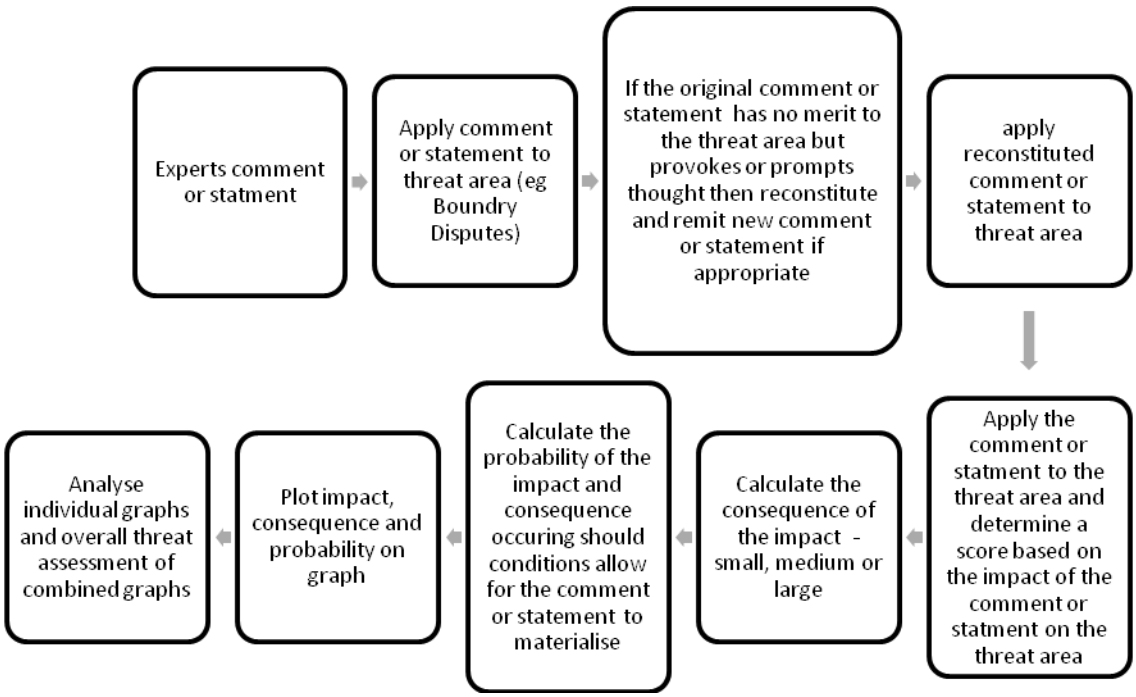
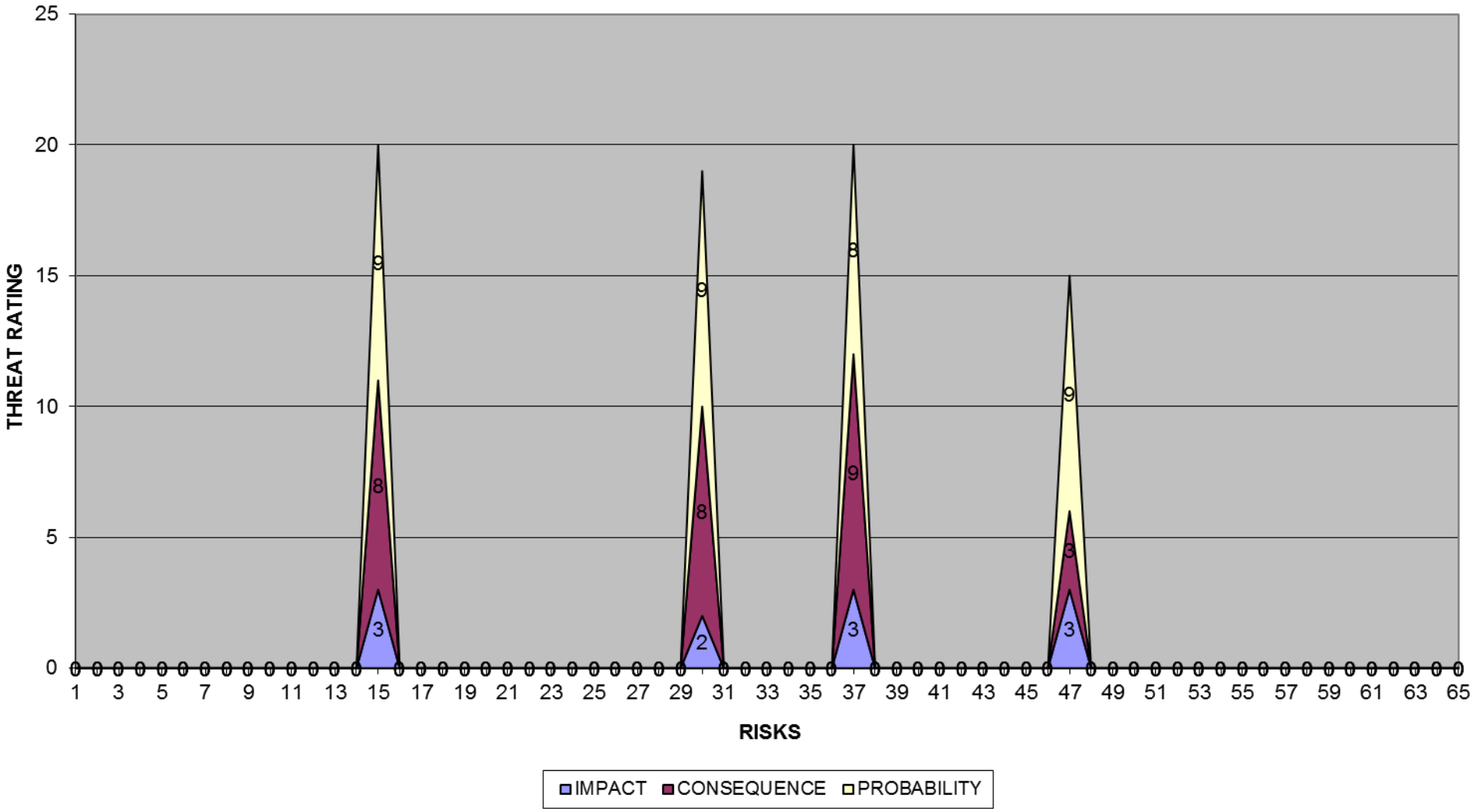


Fig 4.5 Scoring methodology

[244] Hewson, Paul, *op cit*

This is also the case where the same comment appears scored on several graphs. The comment may accrue a different impact score depending on how the original comment is reconstituted in relation to the eight different risk factors. The impact and consequence scores were marked as they would in a worst case scenario situation. When scoring the ‘consequence’ element, the score is based on the consequence of the impact.

Fig 4.6 BOUNDARY DISPUTES



I found that four points could possibly cause a supply disruption due to potential boundary disputes.

Ongoing

15. Iran cannot protect itself (Hooton).
30 No real M/E leadership figure (Butter).

Current

37 US dependency on M/E oil overstated in political debate (Butter).

Future

47 If safer fields are found and commercially viable deposits become exploited the interest in M/E oil may fall (Glenn).

Taking into account the scoring process applied to the four comments relevant to potential boundary disputes is explained below:

In comment (15) Hooton argues that Iran cannot protect itself. However the impact score was calculated as if Tehran were able to retaliate over the intrusion of the Iranian seabed border in the Gulf this may at worst case cause a small supply disruption.

Butter states in comment (30) that the Middle East has no real leadership figure. The statement was turned around and scored as if there will be a leadership figure and that being the case a leader could choose to interfere between neighbouring states and disrupt supply for political reasons aimed against consumers.

Butter further states in comment (37) that US dependency in oil is overstated. This being the case the comment was scored after taking into consideration that the US would probably not interfere with a minor disruption to supply caused by neighbouring states arguing over border demarcation as Washington did not personally depend on the product.

Glenn argues in comment (47) that if oil is found elsewhere then interest in Middle East oil might fall. This comment was scored along the lines of disruptions caused

between Gulf producing states if they were left to fight their own battles between neighbouring states.

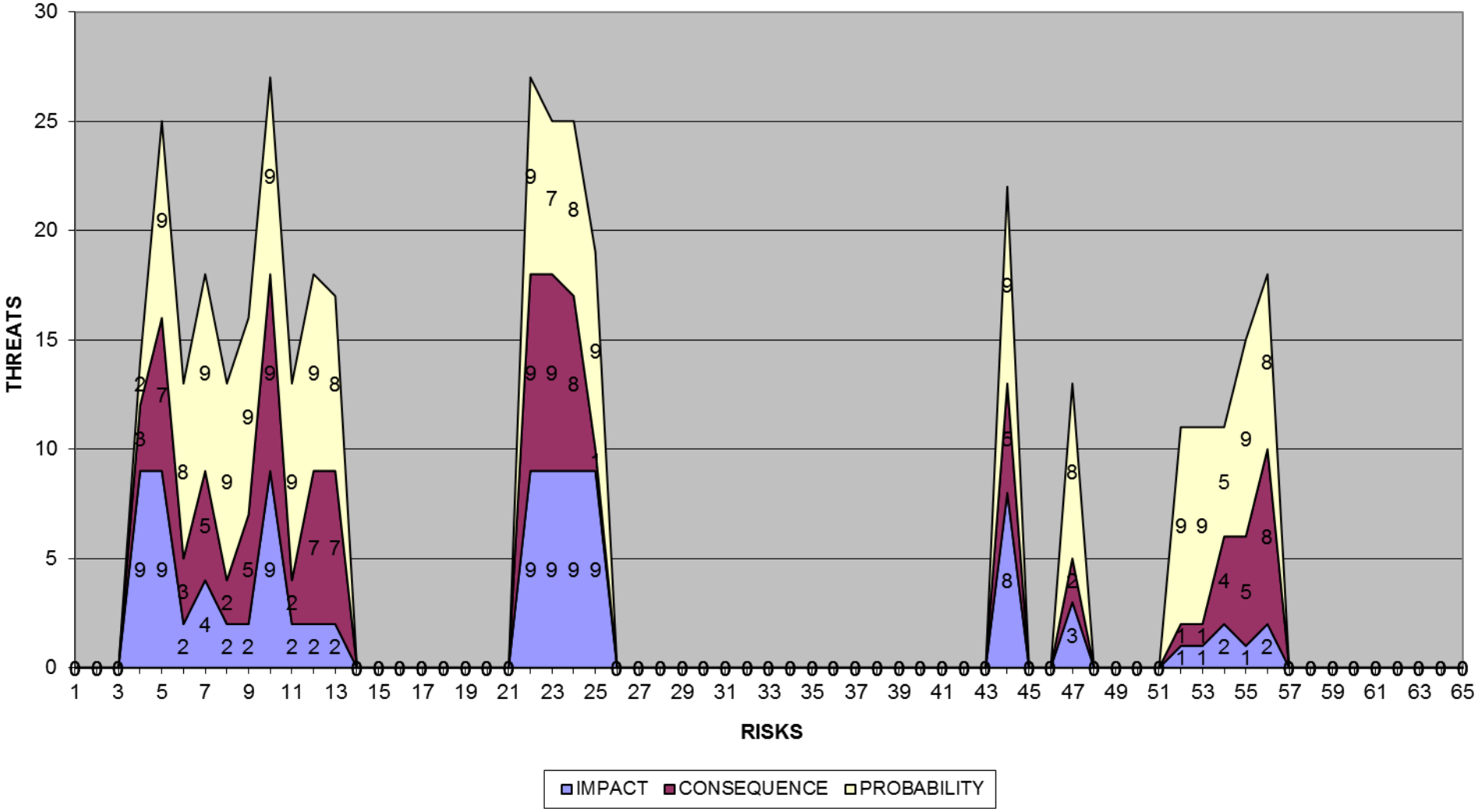
Analysis

Disruptions caused by boundary disputes had prior to 9/11 featured quite prominently. However, since the threat of interstate war since the removal of Saddam Hussein ongoing threats centred on the possibility of seabed infringements and the possibility of a dominant figure replacing Saddam. Current risks would rely on the US deciding not to become involved in a border dispute and a future risk would see the US relax security in the Gulf because abundant oil could be found elsewhere. The consequences of any of these threats materializing range from low to high while the probability is also high if the right conditions were allowed to manifest themselves. Boundary disputes, despite the above do not appear to be a live threat because the likelihood of any of the events taking place is small, and the likelihood of multiple events taking place simultaneously is even smaller.

Risk (Political)	**Threat**	**Impact**	**Consequence**	**Probability**	**Likelihood**
Boundary disputes **(Political)**	Interstate War **(Political)**	Medium	Low/Medium	Low	Low

Fig 4.7 Boundary disputes risk table

Fig 4.8 SAUDI INSTABILITY



No	Expert	Threat	Interpretation	Justification	Status
3	Glenn	ISPS-caused tension among crews and nationalities.	*An ongoing issue regardless of tanker design.*	Traditional methods of crewing and recruitment may be challenged	Ongoing
4	Halliday	Limburg-insurance levels-attack to destabilize Yemen (Halliday).	*A similar event could occur originating from a Gulf State.*	Increased insurance as damaging as physical damage	Ongoing
5	Butter	Iraq pipeline damage a 'carefully calibrated scam' (Butter).	*Attack(s) on pipelines*	Attacks on pipelines appear worse than they really are	Ongoing
6	Butter	Al-Qaeda damaging to Saudi-ex-pats leaving.	*Shortage of qualified engineers*	Terrorism causes intellectual as well as physical damage	Ongoing
7	Hooton	Overlooked point-USA is an 18th Century nation-said to want power but not be responsible for it.	*Continued policy friction*	US does not always intervene	Ongoing
8	Hooton	M/E Policy deeply religiously motivated	How will Sunni and Shia live side by side?	Non-political conflict difficult to politically manage	Ongoing
9	Hooton	Christian fundamentalists in USA driving policy towards Israel.	*US enacts a policy which becomes detrimental to production*	US Foreign Policy tries to please domestic voters	Ongoing
10	Hooton	Saudi/Islamic society in M/E Gulf difficult to adapt	*Will the Gulf states adapt to a Sunni/Shia divide?*	Level of conflict between Shi/Sunni communities unknown	Ongoing
11	Hooton	Religious decrees are state policy	*Will Gulf state policy result in friction?*	Saudi policies often clash with US policies	Ongoing
12	Hooton	Cannot adjust-spoken work-illiteracy.	*Potential terrorists easier to influence and recruit*	Potential rise in terrorism	Ongoing
13	Hooton	No Arab states (except Egypt) have the infrastructure to build weapons or capability to destroy Israel.	*If this changes will it be easier for terrorists to procure arms?*	Regardless the US take Iranian threats seriously	Ongoing
22	Glenn	IMO-minimize impact on owners who have got it in hand	*Will owners refuse to send new double hull tankers into a terrorist area?*	Technical risk to tankers unknown	Ongoing
23	Glenn	Titanic triggered SOLAS	*SOLAS was reactionary. Will there be a reactionary action to double hull tankers if*	Technical risk to tankers unknown	Ongoing

			they are susceptible to terrorist damage?		
24	Glenn	'Herald of Free Enterprise' and 'Estonia' moved regulation forward	*If double hull tankers move regulation forward will the regulation impact on their ability to steam in the Gulf?*	Technical risk to tankers unknown	Ongoing
25	Butter	Algeria-little disruption during civil conflict	*Will the opposite prove true in the Gulf?*	Regardless the US take Iranian threats seriously	Ongoing
43	Hooton	Any attempt to mine the Straits of Hormuz would attract international retaliation	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current
44	E.A. Gibson	Saudi's building 3 refineries in the Gulf	*Increased traffic of finished product.*	Increases tanker traffic	Emerging
46	E.A. Gibson	Shortage of tankers for a 'shuttle service'	*Oil industry would have to rethink previous arrangements for exporting oil from the Gulf during conflict.*	Conflict in the Gulf stretch the armed forces	Emerging
47	Glenn	If safer fields are found and commercially viable deposits become exploited the interest in M/E oil may fall	*Gulf security may fall as interest shifts elsewhere*	Fall in Gulf security	Future
51	Glenn	Age profile-diminish-who replaces them-Indian seafarers retire at 50 (made money by then)	*Could long term crewing problems affect supply?*	Conflict in the Gulf stretch the armed forces	Future
52	Hooton	Japan-no foreign military experience	*Major Gulf oil customers may not be deployed to defend their interests*	Conflict in the Gulf stretch the armed forces	Future
53	Hooton	Japan-constitutional problems in sending troops abroad	*Major Gulf oil customers may not be deployed to defend their interests*	Conflict in the Gulf stretch the armed forces	Future
54	Hooton	Is China capable of defending the Gulf?	*Questionable foreign involvement too risky to rely on.*	Conflict in the Gulf stretch the armed forces	Future
55	Hooton	How much religious 'feeling' remains after Iraq war?	*Level of future unrest unknown*	Potential rise in terrorism	Future
56	Hooton	How will the affected generation grow up?	*Level of future unrest unknown*	Potential rise in terrorism	Future
57	Hooton	Iranian attack on Jerusalem unlikely-Iranians are not	*If Iran were to attack Israel would this act affect supply?*	Regardless the US take Iranian threats seriously	Future

		Jews, Arabs or Christians)			
58	Hooton	Mine's in shallow waters only, in the deep middle the current is too strong	*Shipping lanes may not be mined*	Technical risk to tankers unknown	Future
59	Hooton	Submarines-greatest threat	*How far do Iran's capabilities extend?*	Conflict in the Gulf stretch the armed forces	Future
60	Hooton	Anti-sub ships-India, Pakistan and China would join in	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
61	Hooton	Russia would join in for the money	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
62	Hooton	May result in convoys of tankers	*Conflict in the Strait of Hormuz would present a crisis situation.*	Conflict in the Gulf stretch the armed forces	Future
63	Hooton	Anti-ship missiles can be detected	*Detection technology has improved since the tanker war.*	Technical risk to tankers unknown	Future
64	Hooton	Missile technology has not been directed at tankers-propulsion and guidance development not warhead	*Weapons directed at oil tankers have not changed since the tanker war.*	Technical risk to tankers unknown	Future
65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

Analysis

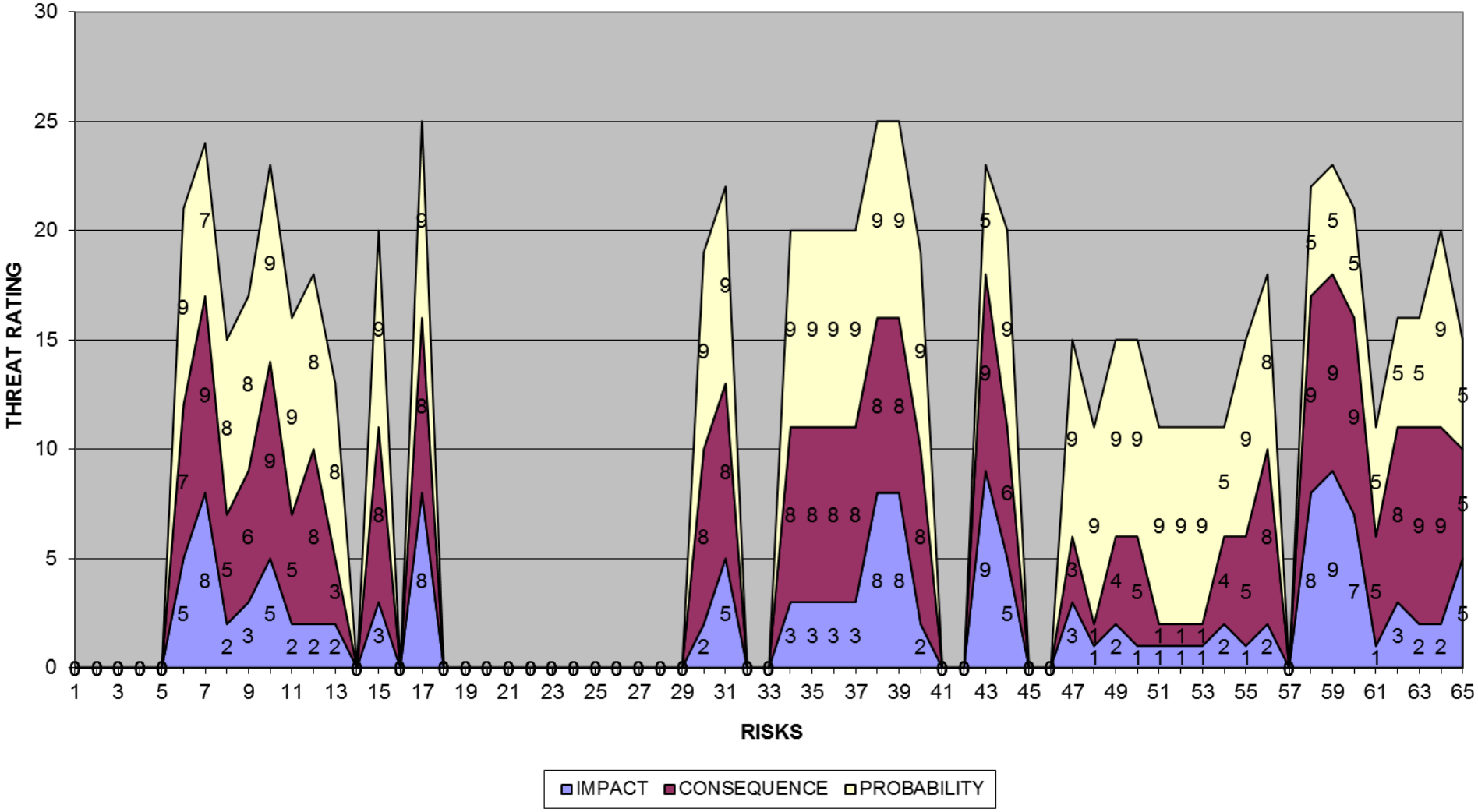
Ongoing risks to the Saudi oil supply chain include potential recruitment of terrorists, attacks on pipelines, refineries and the wider infrastructure. This conclusion concurs with the CEPMLP prediction. The possible infiltration of tanker crews by terrorists and attacks on shipping also feature. In the longer term disapproval aimed at the United States could attract more recruits. The implausible threats pointed towards terrorism causing Washington to source oil elsewhere, which is thoroughly unrealistic. The potential impact on the supply chain peaks where shipping becomes the target.

Saudi Arabia relies on oil tankers to export crude and any challenge to the security of these vessels is of paramount importance. The limitations are that terrorists do not have unlimited resources and manpower so it is unlikely that multiple events will take place simultaneously. However, it is just as unlikely that the Saudi oil infrastructure will not be targeted by terrorists at some point due to the global importance and publicity such an attack would bring regardless of the impact and consequence. For this reason the threat Saudi Arabia affords lies in the likelihood that the Kingdom will adopt an unfortunate position as a terrorist recruiting ground and the potential for terrorist attacks aimed at the Kingdom's oil infrastructure will become high.

Risk (Political)	**Threat**	**Impact**	**Consequence**	**Probability**	**Likelihood**
Saudi instability	Recruitment of terrorists **(Demographic)**	Low/Medium	Medium/High	High	High
	Acts of terrorism **(Political)**	Medium/High	Medium/High	High	High

Fig 4.9 Saudi instability risk table

Fig 4.10 IRAN AT A GEOPOLITICAL PREMIUM



No	Expert	Threat	Interpretation	Justification	Status
5	Butter	Iraq pipeline damage a 'carefully calibrated scam' (Butter).	*Attack(s) on pipelines*	Attacks on pipelines appear worse than they really are	Ongoing
6	Butter	Al-Qaeda damaging to Saudi-ex-pats leaving.	*Shortage of qualified engineers*	Terrorism causes intellectual as well as physical damage	Ongoing
7	Hooton	Overlooked point-USA is an 18th Century nation-said to want power but not be responsible for it.	*Continued policy friction*	US does not always intervene	Ongoing
8	Hooton	M/E Policy deeply religiously motivated	How will Sunni and Shia live side by side?	Non-political conflict difficult to politically manage	Ongoing
9	Hooton	Christian fundamentalists in USA driving policy towards Israel.	*US enacts a policy which becomes detrimental to production*	US Foreign Policy tries to please domestic voters	Ongoing
10	Hooton	Saudi/Islamic society in M/E Gulf difficult to adapt	*Will the Gulf states adapt to a Sunni/Shia divide?*	Level of conflict between Shi/Sunni communities unknown	Ongoing
11	Hooton	Religious decrees are state policy	*Will Gulf state policy result in friction?*	Saudi policies often clash with US policies	Ongoing
12	Hooton	Cannot adjust-spoken work-illiteracy.	*Potential terrorists easier to influence and recruit*	Potential rise in terrorism	Ongoing
13	Hooton	No Arab states (except Egypt) have the infrastructure to build weapons or capability to destroy Israel.	*If this changes will it be easier for terrorists to procure arms?*	Regardless the US take Iranian threats seriously	Ongoing
14	Hooton	Naval operations in the Gulf are marred by a 30 metre haze on the surface of the sea	*How would this affect a future closure of the Strait of Hormuz?*	Conflict in the Gulf stretch the armed forces	Ongoing
15	Hooton	Iran cannot protect itself	*Would Iran therefore not attempt to disrupt supply?*	Regardless the US take Iranian threats seriously	Ongoing
16	Glenn	Saudi reserves higher now than in the 70's	*The reserves may be higher but is the technology available to extract the oil?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
17	Butter	Oil marker works on the Dollar	*Do the Iranians resent this?*	Regardless the US take Iranian threats seriously	Ongoing
18	Glenn	Past behaviour – OPEC on full power – market share of	*Could OPEC compensate for a major M/E disruption?*	Can Saudi Spare Production Capacity meet demand?	Ongoing

		M/E oil fell dramatically			
29	Glenn	Current high price maybe due to low refining capacity	*Are refineries the key target for disruptions*	Can Saudi Spare Production Capacity meet demand?	Ongoing
30	Butter	No real M/E leadership figure	*If a leader were to emerge, would they restrict supply?*	Regardless the US take Iranian threats seriously	Ongoing
31	Glenn	Few State owned/private players	*Narrow industry decision making*	Will western technology endure?	Ongoing
33	Glenn	Forward projections too assuming	*Assumption is based on free flow of exports*	Can Saudi Spare Production Capacity meet demand?	Current
34	Hooton	Iran's nuclear ambition is a statement	*Doubt over Iran's capability to develop nuclear power and/or weapons*	Regardless the US take Iranian threats seriously	Current
35	Hooton	Iran's nuclear program is a threat reduction exercise	*At what point will Iran's nuclear program be considered too big a risk to destroy by hostile forces*	Regardless the US take Iranian threats seriously	Current
36	Butter	Iranian decision making process difficult-Mullahs have overruled the President	*Will Iran decide to block the Strait of Hormuz?*	Regardless the US take Iranian threats seriously	Current
37	Butter	US dependency on M/E oil overstated in political debate	*Just how important will spare production capacity be in the future?*	Can Saudi Spare Production Capacity meet demand?	Current
38	Butter	Iran-adverse pressure has depressed production (4MMBD for next 5 years	*Will any adverse pressure be applied to any of the Gulf States? If so, will the pressure reduce production?*	Can Saudi Spare Production Capacity meet demand?	Current
39	Butter	Iranian gas projects suffered as a result of nuclear program and internal politics	*How much will the Gulf States invest in future projects?*	Will western technology endure?	Current
40	CGES	Iranian agricultural industry returns as much to GDP as the oil industry	*Belief that Iran depends on oil alone*	Regardless the US take Iranian threats seriously	Current
41	E.A. Gibson	Shell proven reserves crisis motivated interest in the industry as well as 9/11.	*Are Iran's proven reserves accurate?*	Regardless the US take Iranian threats seriously	Current
43	Hooton	Any attempt to mine the Straits of Hormuz would	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current

		attract international retaliation			
44	E.A. Gibson	Saudi's building 3 refineries in the Gulf	*Increased traffic of finished product.*	Increases tanker traffic	Emerging
45	Glenn	2010 double-hull phase in complete	*Tanker industry struggling to adapt to change in legislation.*	Technical risk to tankers unknown	Emerging
47	Glenn	If safer fields are found and commercially viable deposits become exploited the interest in M/E oil may fall	*Gulf security may fall as interest shifts elsewhere*	Fall in Gulf security	Future
48	Hooton	The planned Iranian Bourse?	*Which currency would the Bourse trade in? And if it were not the dollar then how would the US react*	Increased sanctions against Iran	Future
49	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future
50	Glenn	Meeting of Commodores in 1996-Crisis if number of Officers fell below 10,000 (Glenn).	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future
51	Glenn	Age profile-diminish-who replaces them-Indian seafarers retire at 50 (made money by then)	*Could long term crewing problems affect supply?*	Conflict in the Gulf stretch the armed forces	Future
52	Hooton	Japan-no foreign military experience	*Major Gulf oil customers may not be deployed to defend their interests*	Conflict in the Gulf stretch the armed forces	Future
53	Hooton	Japan-constitutional problems in sending troops abroad	*Major Gulf oil customers may not be deployed to defend their interests*	Conflict in the Gulf stretch the armed forces	Future
54	Hooton	Is China capable of defending the Gulf?	*Questionable foreign involvement too risky to rely on.*	Conflict in the Gulf stretch the armed forces	Future
55	Hooton	How much religious 'feeling' remains after Iraq war?	*Level of future unrest unknown*	Potential rise in terrorism	Future

56	Hooton	How will the affected generation grow up?	*Level of future unrest unknown*	Potential rise in terrorism	Future
57	Hooton	Iranian attack on Jerusalem unlikely- Iranians are not Jews, Arabs or Christians)	*If Iran were to attack Israel would this act affect supply?*	Regardless the US take Iranian threats seriously	Future
58	Hooton	Mine's in shallow waters only, in the deep middle the current is too strong	*Shipping lanes may not be mined*	Technical risk to tankers unknown	Future
59	Hooton	Submarines- greatest threat	*How far do Iran's capabilities extend?*	Conflict in the Gulf stretch the armed forces	Future
60	Hooton	Anti-sub ships- India, Pakistan and China would join in	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
61	Hooton	Russia would join in for the money	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
62	Hooton	May result in convoys of tankers	*Conflict in the Strait of Hormuz would present a crisis situation.*	Conflict in the Gulf stretch the armed forces	Future
63	Hooton	Anti-ship missiles can be detected	*Detection technology has improved since the tanker war.*	Technical risk to tankers unknown	Future
64	Hooton	Missile technology has not been directed at tankers- propulsion and guidance development not warhead	*Weapons directed at oil tankers have not changed since the tanker war.*	Technical risk to tankers unknown	Future
65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

Analysis

Iran's geographical and political position in the Gulf ascribes potential ongoing, current, emerging and future threats to the Gulf oil supply chain. The predominant themes running through all timescales are threats posed by the Iranian regime and its aggressive stance towards the US, Tehran's nuclear ambitions, targeting of oil tankers and the ability of opposing nations to respond to these threats. Howson and Urbach argue that 'with all

things being equal, the larger the apparent effect, the more decisive the inference.'[245] The inference being that due to the threatening nature of Tehran's policies towards Washington and the wider West, Iran has the potential to cause disruptions enacting or defending them. It is also quite possible for multiple events to occur, skirmishes in the Gulf could run parallel with the development of the nuclear programme and politico-religious posturing. Furthermore, the political climate could bring forward the probability of events commented on by interviewees occurring resulting in a high likelihood of events taking place. This said, the threat from Iran fell into three main areas, Tehran's nuclear program, threats to oil tankers and the threat of closing the Strait of Hormuz. In other cases threats were either unrealistic or imbalanced threats that would require a great deal of planning to create a small impact.

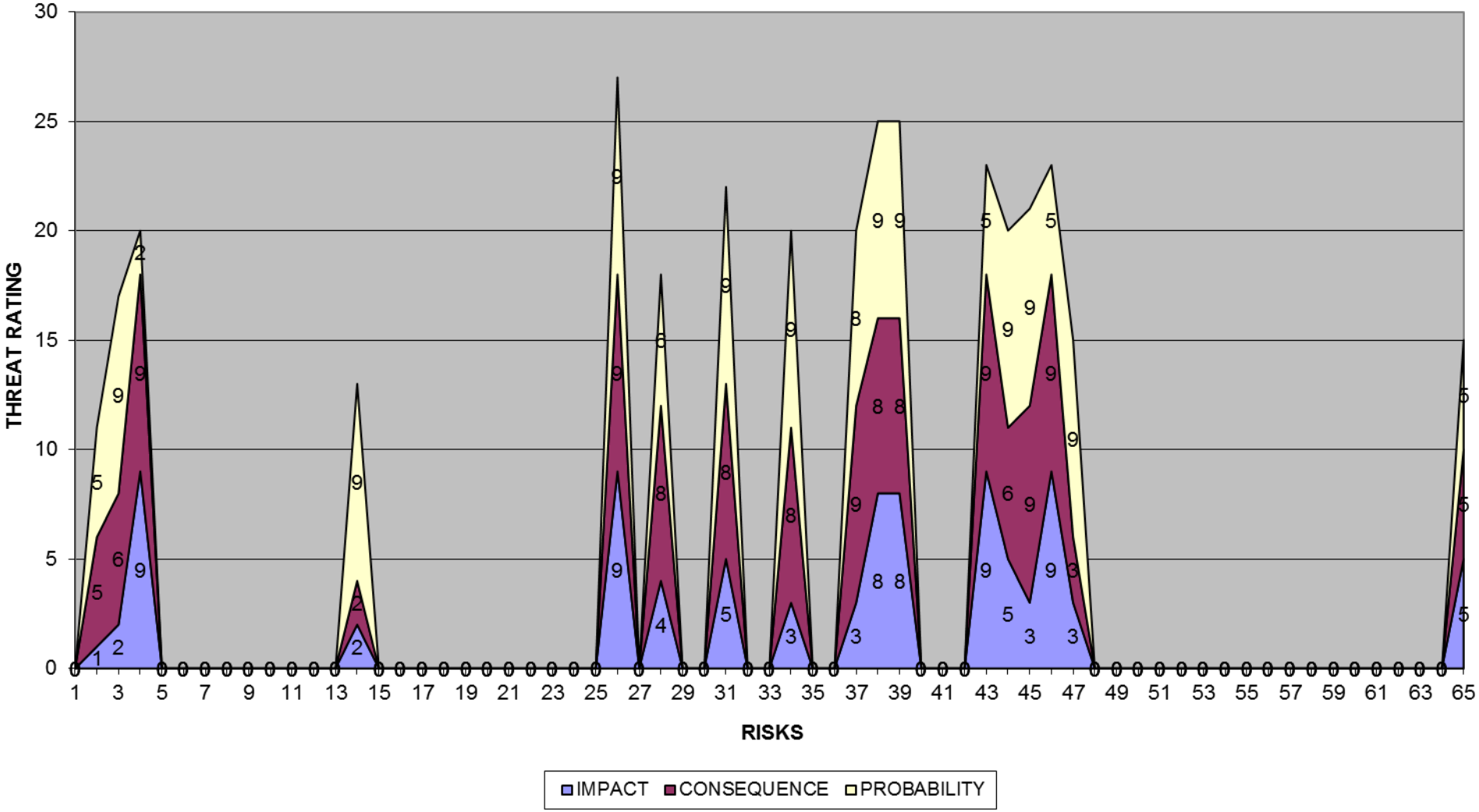
The Iranian regime is in position to cause disruptions in particular by carrying out a threat to close the Strait of Hormuz although the likelihood remains low as the threat is ongoing and has yet to be realized. The potential threat the nuclear programme poses is quite different. The impact could be enormous but a question mark hangs over the probability due to the unknown status of the development of a nuclear weapon. The likelihood of Tehran developing a nuclear weapon is high although once developed the weapon is likely to be used to gain political leverage rather than be launched against a target. Iran has targeted oil tankers in the past but the effect was limited. Nevertheless the threat is a possibility. The question of whether the response by opposing nations towards Tehran would exasperate a disruption, would depend on the nature of the response. This is unknown, as would be the likelihood of such a response ever being needed.

[245] Howson, Colin and Urbach, Peter, *op cit*, 1993, p. 380.

Risk (Political)	Threat	Impact	Consequence	Probability	Likelihood
Iranians at a geopolitical premium **(Political)**	Nuclear programme **(Political)**	High	High	?	Low
	Targeting oil tankers **(Political)**	Low	Low	High	Medium
	Closure of the Strait of Hormuz **(Political)**	High	High	Medium	Medium

Fig 4.11 Iranians at a geopolitical premium risk table

Fig 4.12 US-SAUDI OIL DEPENDENCY OVERSTATED



No	Expert	Threat	Interpretation	Justification	Status
1	Butter	Robust dependable supply chain is an unfortunate contribution to continuing unrest in the M/E	*If the supply chain were to be heavily disrupted how would the US be affected by a drop in supply?*	US will remain dominant in Gulf security	Ongoing
2	Glenn	IMO-tried to improve crew training..	*Will crew issues affect supply?*	Traditional methods of crewing and recruitment may be challenged	Ongoing
3	Glenn	ISPS-caused tension among crews and nationalities.	*An ongoing issue regardless of tanker design.*	Traditional methods of crewing and recruitment may be challenged	Ongoing
4	Halliday	Limburg-insurance levels-attack to destabilize Yemen (Halliday).	*A similar event could occur originating from a Gulf State.*	Increased insurance as damaging as physical damage	Ongoing
5	Butter	Iraq pipeline damage a 'carefully calibrated scam' (Butter).	*Attack(s) on pipelines*	Attacks on pipelines appear worse than they really are	Ongoing
13	Hooton	No Arab states (except Egypt) have the infrastructure to build weapons or capability to destroy Israel.	*If this changes will it be easier for terrorists to procure arms?*	Regardless the US take Iranian threats seriously	Ongoing
14	Hooton	Naval operations in the Gulf are marred by a 30 metre haze on the surface of the sea	*How would this affect a future closure of the Strait of Hormuz?*	Conflict in the Gulf stretch the armed forces	Ongoing
15	Hooton	Iran cannot protect itself	*Would Iran therefore not attempt to disrupt supply?*	Regardless the US take Iranian threats seriously	Ongoing
23	Glenn	Titanic triggered SOLAS	*SOLAS was reactionary. Will there be a reactionary action to double hull tankers if they are susceptible to terrorist damage?*	Technical risk to tankers unknown	Ongoing
25	Butter	Algeria-little disruption during civil conflict	*Will the opposite prove true in the Gulf?*	Regardless the US take Iranian threats seriously	Ongoing
26	Glenn	Technology driven industry can increase/develop extraction	*Will Western technology endure?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
27	Glenn	Club of Rome (ceased in 1995) did not allow for technical revolutions	*Will other predictions omit important factors?*	Technical risk to tankers unknown	Ongoing

28	Butter	Production risks added to supply risks	*Will disruptions occur through conflict or technical failures?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
29	Glenn	Current high price maybe due to low refining capacity	*Are refineries the key target for disruptions*	Can Saudi Spare Production Capacity meet demand?	Ongoing
30	Butter	No real M/E leadership figure	*If a leader were to emerge, would they restrict supply?*	Regardless the US take Iranian threats seriously	Ongoing
31	Glenn	Few State owned/private players	*Narrow industry decision making*	Will western technology endure?	Ongoing
32	E.A. Gibson	Attack on Limburg thought to be an internal explosion which worried insurance companies. Said to be a relief that the blast was caused by terrorists	*Internal explosion could potentially affect every double hull tanker. Terrorism only affects the targeted tanker*	Technical risk to tankers unknown	Ongoing
33	Glenn	Forward projections too assuming	*Assumption is based on free flow of exports*	Can Saudi Spare Production Capacity meet demand?	Current
34	Hooton	Iran's nuclear ambition is a statement	*Doubt over Iran's capability to develop nuclear power and/or weapons*	Regardless the US take Iranian threats seriously	Current
35	Hooton	Iran's nuclear program is a threat reduction exercise	*At what point will Iran's nuclear program be considered too big a risk to destroy by hostile forces*	Regardless the US take Iranian threats seriously	Current
37	Butter	US dependency on M/E oil overstated in political debate	*Just how important will spare production capacity be in the future?*	Can Saudi Spare Production Capacity meet demand?	Current
38	Butter	Iran-adverse pressure has depressed production (4MMBD for next 5 years	*Will any adverse pressure be applied to any of the Gulf States? If so, will the pressure reduce production?*	Can Saudi Spare Production Capacity meet demand?	Current
39	Butter	Iranian gas projects suffered as a result of nuclear program and internal politics	*How much will the Gulf States invest in future projects?*	Will western technology endure?	Current
42	Fanday	Re-flagging-Between communities-Shia flag/Sunni flag?	*Will the widening Sunni/Shia divide affect supply?*	Will Iran influence the Shia/Sunni conflict?	Current
43	Hooton	Any attempt to mine the Straits of Hormuz would	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current

		attract international retaliation			
44	E.A. Gibson	Saudi's building 3 refineries in the Gulf	*Increased traffic of finished product.*	Increases tanker traffic	Emerging
45	Glenn	2010 double-hull phase in complete	*Tanker industry struggling to adapt to change in legislation.*	Technical risk to tankers unknown	Emerging
46	E.A. Gibson	Shortage of tankers for a 'shuttle service'	*Oil industry would have to rethink previous arrangements for exporting oil from the Gulf during conflict.*	Conflict in the Gulf stretch the armed forces	Emerging
47	Glenn	If safer fields are found and commercially viable deposits become exploited the interest in M/E oil may fall	*Gulf security may fall as interest shifts elsewhere*	Fall in Gulf security	Future
65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

Analysis

Whether US-Saudi oil dependency is overstated or not, Washington relies on an unimpeded supply of oil to the market. In this respect the concerns facing supply which encompass ongoing, current, emerging and future risks include the full spectrum of political, supply, technological and demographic threats. The nature of these threats ranges from Tehran's nuclear programme, possible attacks on oil tankers and managing the personnel of tanker crews, the closure of the Strait of Hormuz and conflict arising from the Shia/Sunni divide. It must be said that the first three of these threats also applied to Iran's geopolitical premium and may well be adopted as such in the further study.

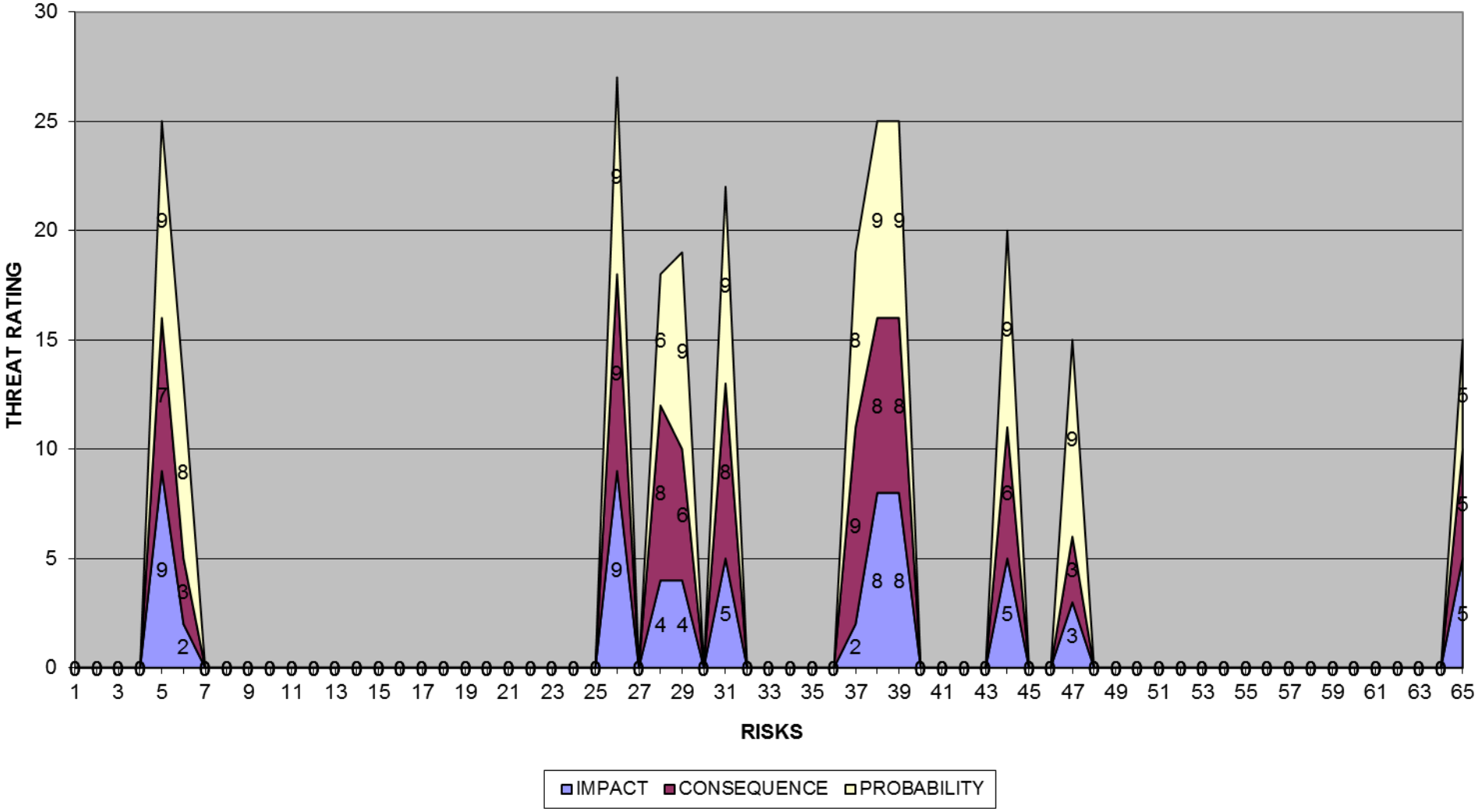
Some of these threats have been recorded being attributed to previous risks. For example in the case of Iran attacks on oil tankers is just one of many threats, but in the case of supplying oil to the market, oil tankers are a key component so the impact would be far greater. The only new risk involves technology in that oil field technology drives

the ability to export crude to both the US and elsewhere. Although multiple events are unlikely there is always the possibility of conflict in the Gulf involving oil tankers which could in turn affect the security of oil field support workers. The likelihood of the nuclear threat remains unknown, the closure of the Strait of Hormuz less so and the possibility of oil tankers being attacked also remains a possibility. The overall likelihood of threats occurring against Gulf oil supply probably relies on the actions of Iran.

Risk (Political)	**Threat**	**Impact**	**Consequence**	**Probability**	**Likelihood**
US-Saudi oil dependency overstated	Nuclear programme **(Political)**	High	High	?	Low
	Closure of the Strait of Hormuz **(Political)**	High	High	Medium	Medium
	Attacks on oil tankers **(Political)**	Low	Low	High	Medium

Fig 4.13 US-Saudi oil dependency overstated risk table

Fig 4.14 LACK OF SPARE PRODUCTION CAPACITY



No	Expert	Threat	Interpretation	Justification	Status
4	Halliday	Limburg-insurance levels-attack to destabilize Yemen (Halliday).	*A similar event could occur originating from a Gulf State.*	Increased insurance as damaging as physical damage	Ongoing
5	Butter	Iraq pipeline damage a 'carefully calibrated scam' (Butter).	*Attack(s) on pipelines*	Attacks on pipelines appear worse than they really are	Ongoing
6	Butter	Al-Qaeda damaging to Saudi-ex-pats leaving.	*Shortage of qualified engineers*	Terrorism causes intellectual as well as physical damage	Ongoing
25	Butter	Algeria-little disruption during civil conflict	*Will the opposite prove true in the Gulf?*	Regardless the US take Iranian threats seriously	Ongoing
26	Glenn	Technology driven industry can increase/develop extraction	*Will Western technology endure?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
27	Glenn	Club of Rome (ceased in 1995) did not allow for technical revolutions	*Will other predictions omit important factors?*	Technical risk to tankers unknown	Ongoing
28	Butter	Production risks added to supply risks	*Will disruptions occur through conflict or technical failures?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
29	Glenn	Current high price maybe due to low refining capacity	*Are refineries the key target for disruptions*	Can Saudi Spare Production Capacity meet demand?	Ongoing
30	Butter	No real M/E leadership figure	*If a leader were to emerge, would they restrict supply?*	Regardless the US take Iranian threats seriously	Ongoing
31	Glenn	Few State owned/private players	*Narrow industry decision making*	Will western technology endure?	Ongoing
36	Butter	Iranian decision making process difficult-Mullahs have overruled the President	*Will Iran decide to block the Strait of Hormuz?*	Regardless the US take Iranian threats seriously	Current
37	Butter	US dependency on M/E oil overstated in political debate	*Just how important will spare production capacity be in the future?*	Can Saudi Spare Production Capacity meet demand?	Current
38	Butter	Iran-adverse pressure has depressed production (4MMBD for next 5 years	*Will any adverse pressure be applied to any of the Gulf States? If so, will the pressure reduce production?*	Can Saudi Spare Production Capacity meet demand?	Current

39	Butter	Iranian gas projects suffered as a result of nuclear program and internal politics	*How much will the Gulf States invest in future projects?*	Will western technology endure?	Current
43	Hooton	Any attempt to mine the Straits of Hormuz would attract international retaliation	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current
46	E.A. Gibson	Shortage of tankers for a 'shuttle service'	*Oil industry would have to rethink previous arrangements for exporting oil from the Gulf during conflict.*	Conflict in the Gulf stretch the armed forces	Emerging
47	Glenn	If safer fields are found and commercially viable deposits become exploited the interest in M/E oil may fall	*Gulf security may fall as interest shifts elsewhere*	Fall in Gulf security	Future
65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

Analysis

As was the case when analysing US-Saudi oil dependency, SPC produced replicated threats that would be better absorbed into other risk factors in the further study. Again there were a high number of implausible or imbalanced threats. Overall the analysis highlighted the need for the risk factor to be more specific in content.

Threats to spare capacity realistically fall on two areas, technology and damage. A lack of technology such as maintenance and parts would affect supply, as would damage inflicted by terrorists of conflict. Infrastructure failures are common and vary in size but failures are an accepted and, as much as can be expected, anticipated event in operations.

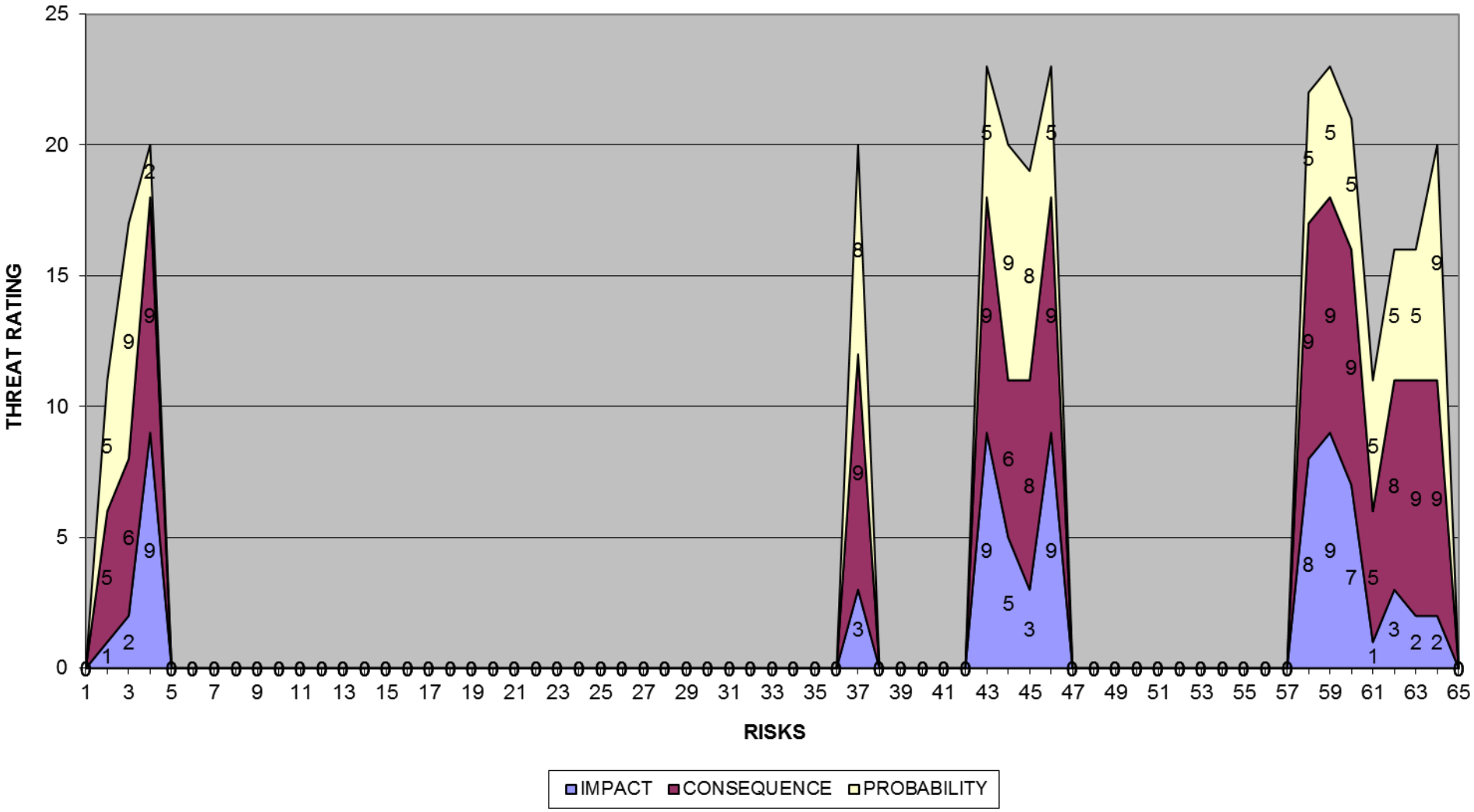
The issue of terrorism is a relative unknown although the likelihood remains high regarding an attack on the infrastructure. The same can be said of damage due to

conflict, but this would depend on the infrastructure being a target. The likelihood is that spare capacity would fall if the infrastructure is damaged although spare capacity in itself is unlikely to be the reason why the infrastructure is targeted.

Risk	Threat	Impact	Consequence	Probability	Likelihood
Lack of spare production capacity **(Supply)**	Terrorism **(political)**	High	High	High	High
	Oil infrastructure failures **(Technology)**	Low/Medium	Low	High	High
	Conflict with Iran **(Political)**	Medium	Medium	Medium/High	Low

Fig 4.15 Lack of spare production capacity risk table

Fig 4.16 DOUBLE HULL TANKERS



No	Expert	Threat	Interpretation	Justification	Status
1	Butter	Robust dependable supply chain is an unfortunate contribution to continuing unrest in the M/E	*If the supply chain were to be heavily disrupted how would the US be affected by a drop in supply?*	US will remain dominant in Gulf security	Ongoing
2	Glenn	IMO-tried to improve crew training..	*Will crew issues affect supply?*	Traditional methods of crewing and recruitment may be challenged	Ongoing
3	Glenn	ISPS-caused tension among crews and nationalities.	*An ongoing issue regardless of tanker design.*	Traditional methods of crewing and recruitment may be challenged	Ongoing
4	Halliday	Limburg-insurance levels-attack to destabilize Yemen (Halliday).	*A similar event could occur originating from a Gulf State.*	Increased insurance as damaging as physical damage	Ongoing
36	Butter	Iranian decision making process difficult-Mullahs have overruled the President	*Will Iran decide to block the Strait of Hormuz?*	Regardless the US take Iranian threats seriously	Current
37	Butter	US dependency on M/E oil overstated in political debate	*Just how important will spare production capacity be in the future?*	Can Saudi Spare Production Capacity meet demand?	Current
42	Fanday	Re-flagging-Between communities-Shia flag/Sunni flag?	*Will the widening Sunni/Shia divide affect supply?*	Will Iran influence the Shia/Sunni conflict?	Current
43	Hooton	Any attempt to mine the Straits of Hormuz would attract international retaliation	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current
44	E.A. Gibson	Saudi's building 3 refineries in the Gulf	*Increased traffic of finished product.*	Increases tanker traffic	Emerging
45	Glenn	2010 double-hull phase in complete	*Tanker industry struggling to adapt to change in legislation.*	Technical risk to tankers unknown	Emerging
46	E.A. Gibson	Shortage of tankers for a 'shuttle service'	*Oil industry would have to rethink previous arrangements for exporting oil from the Gulf during conflict.*	Conflict in the Gulf stretch the armed forces	Emerging
57	Hooton	Iranian attack on Jerusalem unlikely-Iranians are not Jews,	*If Iran were to attack Israel would this act affect supply?*	Regardless the US take Iranian threats seriously	Future

		Arabs or Christians)			
58	Hooton	Mine's in shallow waters only, in the deep middle the current is too strong	*Shipping lanes may not be mined*	Technical risk to tankers unknown	Future
59	Hooton	Submarines-greatest threat	*How far do Iran's capabilities extend?*	Conflict in the Gulf stretch the armed forces	Future
60	Hooton	Anti-sub ships-India, Pakistan and China would join in	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
61	Hooton	Russia would join in for the money	*Support from international community*	Conflict in the Gulf stretch the armed forces	Future
62	Hooton	May result in convoys of tankers	*Conflict in the Strait of Hormuz would present a crisis situation.*	Conflict in the Gulf stretch the armed forces	Future
63	Hooton	Anti-ship missiles can be detected	*Detection technology has improved since the tanker war.*	Technical risk to tankers unknown	Future
64	Hooton	Missile technology has not been directed at tankers-propulsion and guidance development not warhead	*Weapons directed at oil tankers have not changed since the tanker war.*	Technical risk to tankers unknown	Future
65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

Analysis

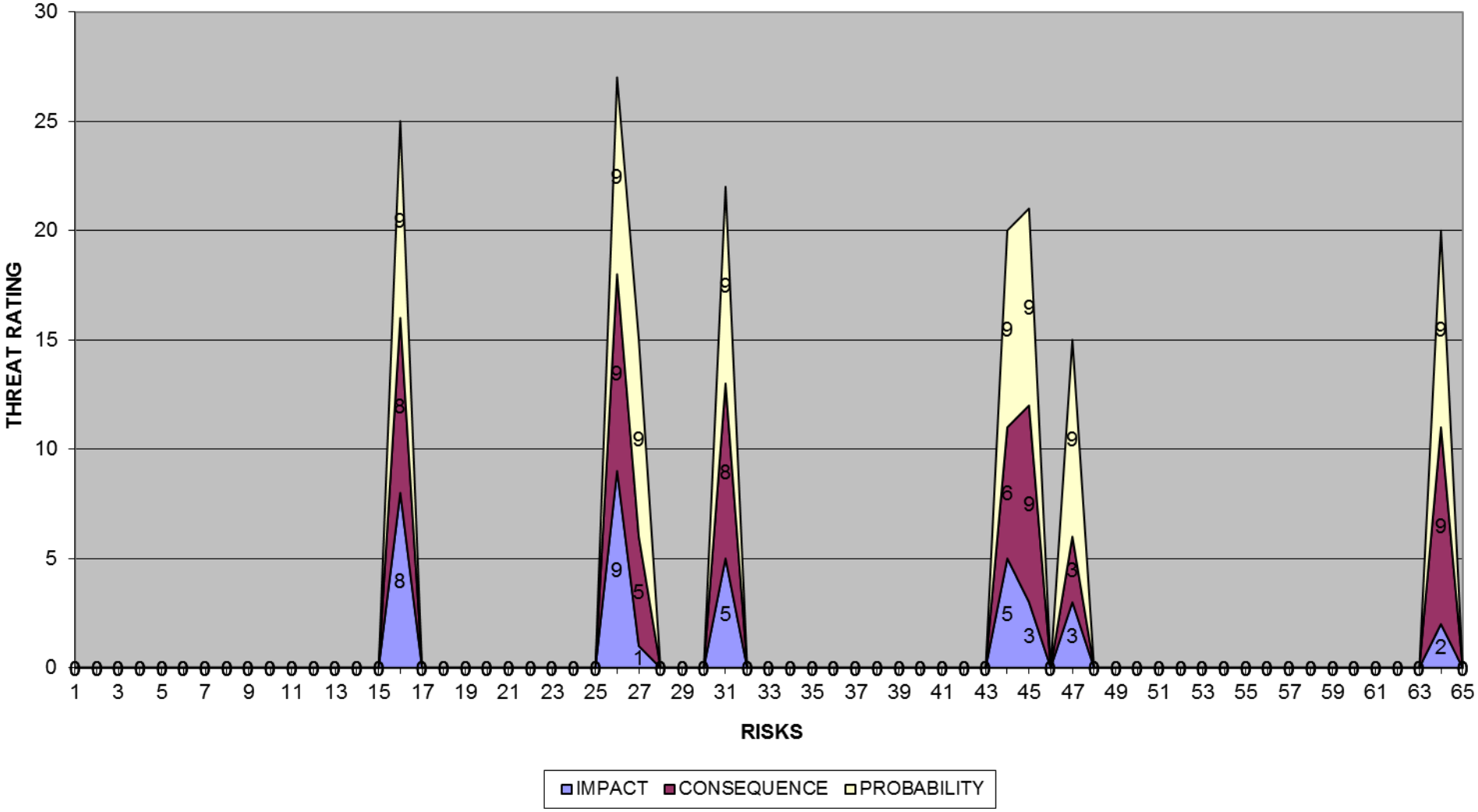
It is highly likely that the resilience of double hull tankers will be tested in combat, or by terrorists, or by both. There was not enough generated data to confirm or deny the resilience of a double hull compared to a single hull design. The high likelihood therefore leaves a series of unknowns regarding impact, consequence and probability which needs to be explored, as a threat to tankers arises in a number of different areas. The possibility of a closure of the Strait of Hormuz would have a greater effect on the tanker shipping industry than individual tankers. The consequence of a closure is however unknown as it would rely on the effectiveness and length of time the Strait was closed to tanker traffic. Given that further study on terrorism and the closure of the Strait of Hormuz will be carried

forward by other risk factors examining the resilience of double hull tankers will remain a priority.

Risk	Threat	Impact	Consequence	Probability	Likelihood
Double hull tankers **(Technology)**	Resilience of design during combat **(Technology)**	?	?	?	High
	Terrorism **(Political)**	Low	Low	High	High
	Closure of the Strait of Hormuz **(Political)**	High	High	Medium	Medium

Fig 4.17 Double hull tankers risk table

Fig 4.18 WESTERN TECHNOLOGY



No	Expert	Threat	Interpretation	Justification	Status
16	Glenn	Saudi reserves higher now than in the 70's	*The reserves may be higher but is the technology available to extract the oil?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
17	Butter	Oil marker works on the Dollar	*Do the Iranians resent this?*	Regardless the US take Iranian threats seriously	Ongoing
25	Butter	Algeria-little disruption during civil conflict	*Will the opposite prove true in the Gulf?*	Regardless the US take Iranian threats seriously	Ongoing
26	Glenn	Technology driven industry can increase/develop extraction	*Will Western technology endure?*	Can Saudi Spare Production Capacity meet demand?	Ongoing
27	Glenn	Club of Rome (ceased in 1995) did not allow for technical revolutions	*Will other predictions omit important factors?*	Technical risk to tankers unknown	Ongoing
30	Butter	No real M/E leadership figure	*If a leader were to emerge, would they restrict supply?*	Regardless the US take Iranian threats seriously	Ongoing
31	Glenn	Few State owned/private players	*Narrow industry decision making*	Will western technology endure?	Ongoing
43	Hooton	Any attempt to mine the Straits of Hormuz would attract international retaliation	*To what extent would the international community retaliate?*	Regardless the US take Iranian threats seriously	Current
44	E.A. Gibson	Saudi's building 3 refineries in the Gulf	*Increased traffic of finished product.*	Increases tanker traffic	Emerging
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46	E.A. Gibson	Shortage of tankers for a 'shuttle service'	*Oil industry would have to rethink previous arrangements for exporting oil from the Gulf during conflict.*	Conflict in the Gulf stretch the armed forces	Emerging
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64	Hooton	Missile technology has not been directed at tankers-propulsion and guidance development not warhead	*Weapons directed at oil tankers have not changed since the tanker war.*	Technical risk to tankers unknown	Future

65	Glenn	There may not be enough UK seafarers to call on in the event of an emergency	*How would the international community provide personnel if a large scale deployment to the Gulf was needed?*	Conflict in the Gulf stretch the armed forces	Future

Analysis

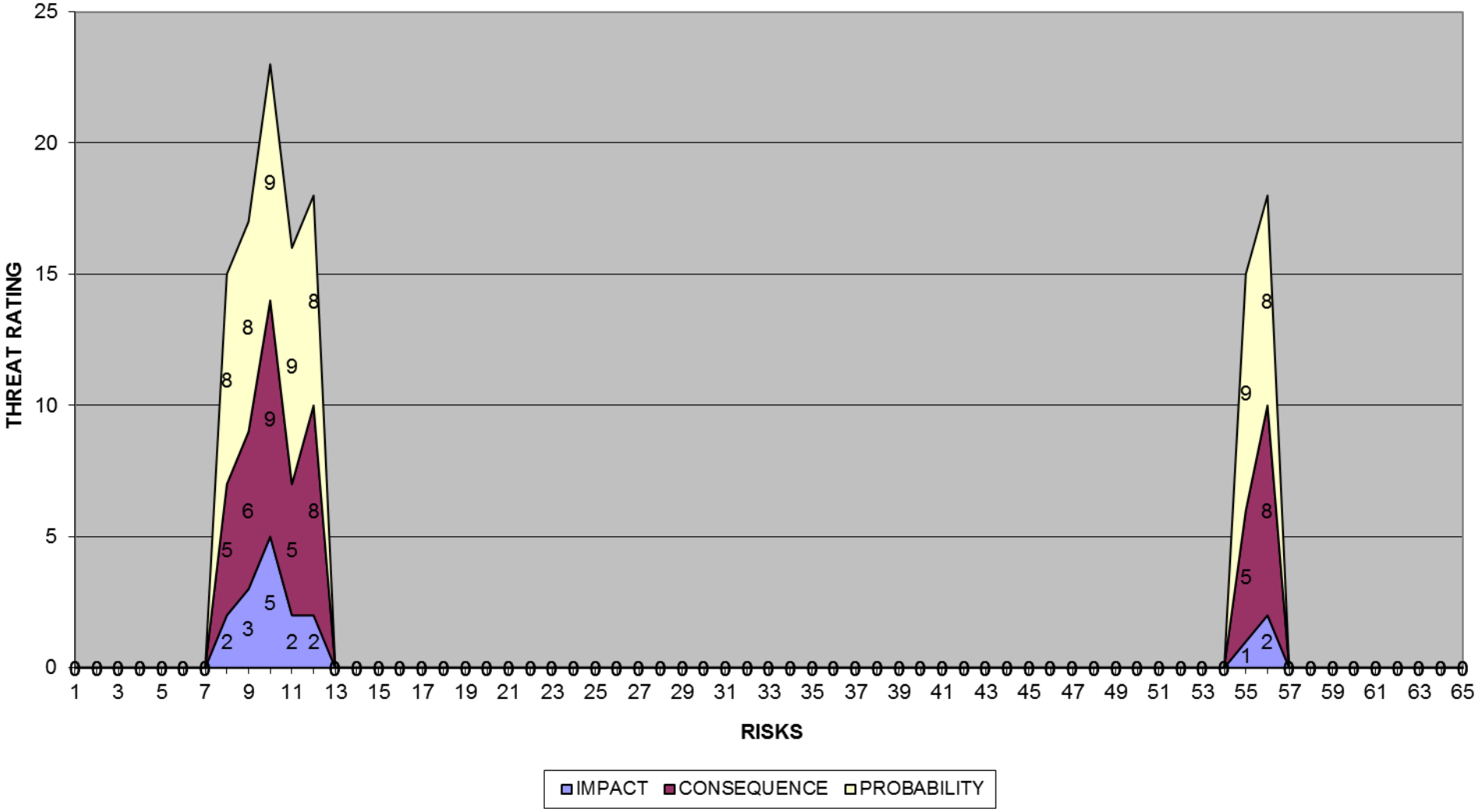
The subject of technology is not widely credited with being a key area of energy security discussion among political scientists. Industry data tends not to examine the geopolitical aspect of oil exploration in much detail so it is difficult to reach an overall consensus on the issue. Fortunately the study did identify China as being a potential emerging threat to traditional US and European suppliers to the KSA. This discovery and the lack of current data indicate a need to pursue this issue.

The US and Europe have held a long running relationship supplying technology to Gulf oil exporting states. It is unlikely that the US and Europe will withdraw from this arrangement. This leaves China as being the main threat to the status quo. The possibility that Saudi Arabia may decide to procure Chinese technology and technical services in the future could affect the supply chain. Local technology is available but not on a large scale. There is a high likelihood that China will enter the oil field technology market but the impact is unknown.

Risk	Threat	Impact	Consequence	Probability	Likelihood
Western Technology **(Technology)**	Is Chinese technology able to replace Western technology **(Technology)**	?	?	?	High

Fig 4.19 Technology needed from the west risk table

Fig 4.20 SUNNI/SHIA DIVIDE



No	Expert	Threat	Interpretation	Justification	Status
7	Hooton	Overlooked point-USA is an 18th Century nation-said to want power but not be responsible for it.	*Continued policy friction*	US does not always intervene	Ongoing
8	Hooton	M/E Policy deeply religiously motivated	How will Sunni and Shia live side by side?	Non-political conflict difficult to politically manage	Ongoing
9	Hooton	Christian fundamentalists in USA driving policy towards Israel.	*US enacts a policy which becomes detrimental to production*	US Foreign Policy tries to please domestic voters	Ongoing
10	Hooton	Saudi/Islamic society in M/E Gulf difficult to adapt	*Will the Gulf states adapt to a Sunni/Shia divide?*	Level of conflict between Shi/Sunni communities unknown	Ongoing
11	Hooton	Religious decrees are state policy	*Will Gulf state policy result in friction?*	Saudi policies often clash with US policies	Ongoing
12	Hooton	Cannot adjust-spoken work-illiteracy.	*Potential terrorists easier to influence and recruit*	Potential rise in terrorism	Ongoing
54	Hooton	Is China capable of defending the Gulf?	*Questionable foreign involvement too risky to rely on.*	Conflict in the Gulf stretch the armed forces	Future
55	Hooton	How much religious 'feeling' remains after Iraq war?	*Level of future unrest unknown*	Potential rise in terrorism	Future

Analysis

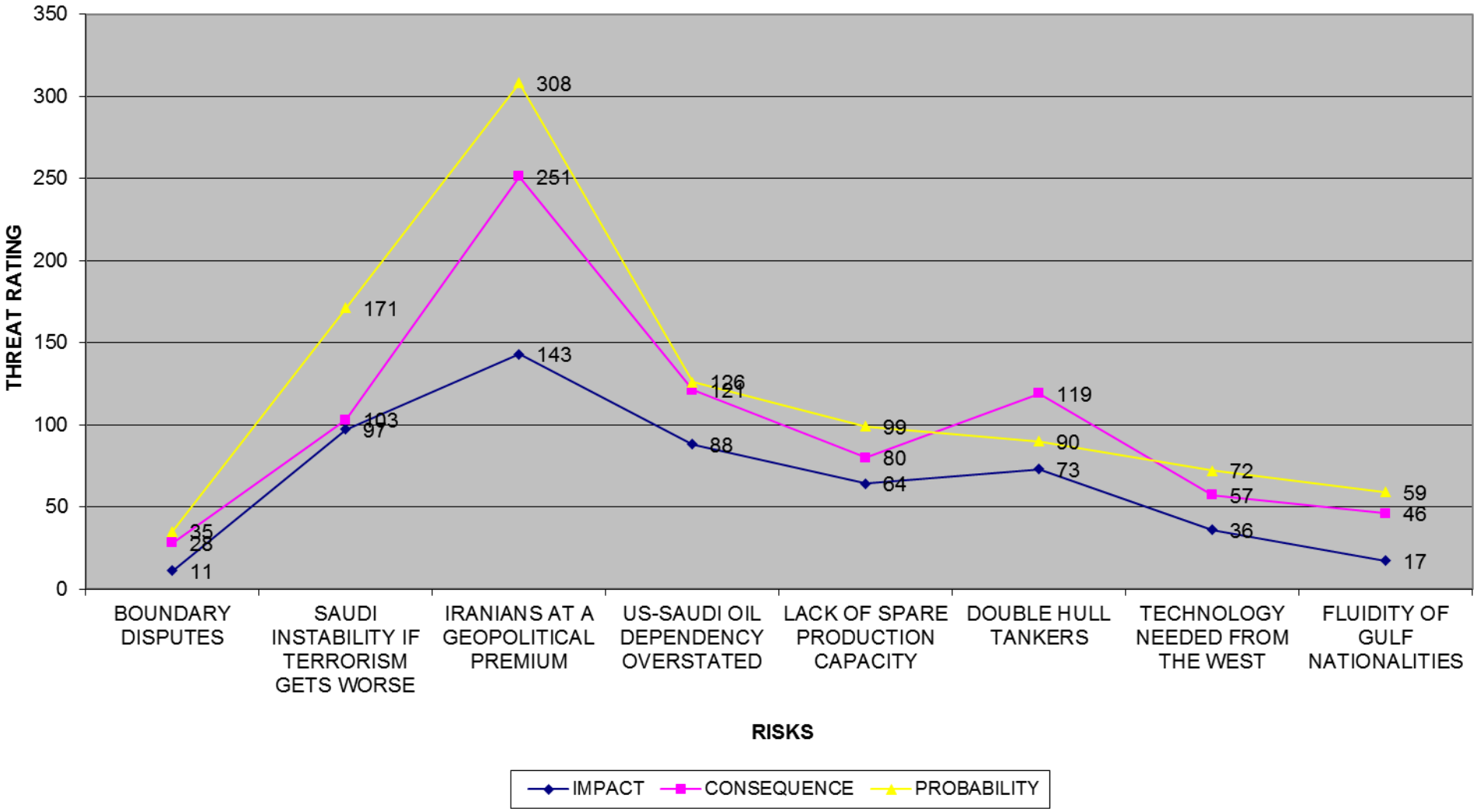
As discussed earlier the Sunni/Shia divide was an emerging issue at the time of the study. Subsequent events dictate that the subject must be carried forward in the further study.

The Shia/Sunni divide is likely to affect the oil supply chain if the situation results in violent unrest that either targets the infrastructure or in cases where the infrastructure is damaged but not directly targeted during unrest. The question of whether unrest increases could be linked to policies directed by ruling families who can be both religious and political leaders.

Risk	Threat	Impact	Consequence	Probability	Likelihood
Shia/Sunni divide	Politico-religious policies **(Political)**	Low	Medium	High	High

Fig 4.21 Sunni/Shia risk table

Fig 4.22 PRIOR DISTRIBUTION



Risk factors	Threat	Impact	Consequence	Probability	Likelihood
Boundary disputes (**Political**)	Interstate War **(Political)**	Medium	Low/Medium	Low	Low
Saudi instability **(Political)**	Recruitment of terrorists **(Demographic)**	Low/Medium	Medium/High	High	High
	Acts of terrorism **(Political)**	Medium/High	Medium/High	High	High
Iranians at a geopolitical premium **(Political)**	Nuclear programme **(Political)**	High	High	?	Low
	Attacks on oil tankers **(Political)**	Low	Low	High	Medium
	Closure of the Strait of Hormuz **(Political)**	High	High	Medium	Medium
US-Saudi oil dependency overstated **(Supply)**	Nuclear programme **(Political)**	High	High	?	Low
	Closure of the Strait of Hormuz **(Political)**	High	High	Medium	Medium
	Attacks on oil tankers **(Political)**	Low	Low	High	Medium
Lack of spare production capacity **(Supply)**	Terrorism **(political)**	High	High	High	High
	Oil infrastructure failures **(Technology)**	Low/Medium	Low	High	High
	Conflict with Iran **(Political)**	Medium	Medium	Medium/High	Low
Double hull tankers **(Technology)**	Resilience of design during combat **(Technology)**	?	?	?	High
	Terrorism **(Political)**	Low	Low	High	High
	Closure of the Strait of Hormuz **(Political)**	High	High	Medium	Medium
Western technology **(Technology)**	Is Chinese technology able to replace Western technology **(Technology)**	?	?	?	High
Shia/Sunni divide **(Demographics)**	Politico-religious policies **(Politico-religious)**	Low	Medium	High	High

Fig 4.23 Prior distribution threat table

Prior distribution summary

The prior distribution summary graph contains the amalgamated impact, consequence and probability total of each of the eight individual risks measured. The prior distribution threat table (above) lists the number of realistic threats posed to each risk. The summary does not include improbable threats that were identified when the graphs were analysed.

The prior distribution graph points to some risks being greater than others where the probability is higher than the impact and consequence. In cases where the probability is just above the impact and consequence, it is unlikely that the impact would occur. In the case of double hull tankers the probability is between the impact and consequence indicating that in this case there is not enough technical data to calculate the probability of an event occurring.

The table contains an indication of the likelihood of an event from realistically happening. The logic being that even if the right conditions for a threat were to occur, the actual likelihood of the event realistically happening given historical and other known evidence is low, medium or high.

Given that each of the eight risk factors were tested against sixty five perceived threats, overall the total threat rating score applied to each of the eight risk factors on the graph is representative of the results on the Prior Distribution Threat Table. Both the Prior Distribution Graph and Prior Distribution Threat Table qualify themselves in that the data is compatible. Below is a summary of the eight risk factors. The summary will discuss whether the individual risk factor is worthy of further study or not and if the threats associated with a risk factor will be absorbed by a more appropriate risk factor in the group.

Boundary disputes

At the beginning of the exercise boundary disputes were calculated as being a medium threat to the oil supply chain. The observation records that there is a low likelihood that an event will take place. Although a boundary disputes were fought over during the Iran-Iraq war and led to the invasion of Kuwait by Iraq causing a large supply disruption, the

removal of Saddam Husain has significantly removed the threat towards boundary disputes. Given the available data, boundary disputes as a stand-alone risk need not be included in any further study.

Saudi instability

The two main threats to the supply chain if terrorism increases in Saudi Arabia are the recruitment of terrorists and acts of terror. The data pointed to any other threats as being unlikely. Existing knowledge indicated that there is a high likelihood of recruitment and acts of terror already taking place and will continue to do so in the future. Immediately post 9/11 terrorism was viewed as a discontinuation away from traditional methods of conflict in the Gulf region. Terrorism has to some extent endured. For this reason terrorism will be viewed as a continuation, in that acts of terror continue to be a current ongoing political threat.

Iran at a geopolitical premium

The observation indicated that Iran posed three main threats to the oil supply chain. Tehran's nuclear programme has a high likelihood of succeeding but whether Tehran will use a nuclear weapon in anger or keep their arsenal as a deterrent is unclear. There is a low likelihood that Iran will target oil tankers even though Tehran has previously carried out attacks in the 'tanker war' and retains the means and ability to do so again. Tehran has threatened to attack tankers on many occasions since the tanker war but has failed to execute the threat. The regime could disrupt supply by closing the Strait of Hormuz. Iran has threatened to close the Straits before but as yet Tehran has yet to act or revealed how they could close the Strait. In all three cases the probability is that conditions for an event could materialise however the likelihood of the threat being executed is low. Iran continues to hold the latent capability to threaten KSA oil exports. Tehran's nuclear program was a discontinuation away from traditional ordnance. However, the program has endured against international pressure and will be cited as a continuing ongoing program leading to a future political threat.

US-Saudi oil dependency overstated

As discussed earlier the threats identified will be absorbed by other risk factors in further study.

Lack of Spare Production Capacity (SPC)

As discussed earlier the threats identified will be absorbed by other risk factors in further study.

Double hull tankers

Analysis of the graph identifies the need for further study to determine whether the consequence of an impact will be any better or worse than to a single hull tanker. Double hull tankers were a discontinuation away from single hull tankers. Double hulls face two major threats, being targeted in combat and the resilience of their design. Further study will cite double hull tankers as a continuing ongoing technological risk. How double hull tankers react in combat depends largely on their resilience. However, the unknown data in this area has created a collapse in the graph, where there is a distinct probability of impact but a void in determining the consequence. Given that there is a high future likelihood of tankers being targeted by terrorists, and in combat, this knowledge is key to determining risk. The threats of terrorism and the closure of the Strait of Hormuz would be better absorbed by other risk factors in later study. Absorbing and merging threats will not alter the overall results. Duplicating threats will only produce unnecessary data to analyse.

Western technology

The graph indicates that threats to the traditional US and European providers of technology could impact on supply. The introduction of China to the oil field service sector has already gained momentum. The extent, quality and reliability of Chinese products in the market is currently unknown. Given that China is identified as having a prolific problem breaching copyright and producing cheap counterfeit items, the threat China poses to traditional suppliers and the oil supply chain has potential. China's introduction

was a discontinuation away from traditional US and European suppliers. China has to some extent established itself as a supplier. This being the case China is viewed in further study as a continuing ongoing technological threat. Data on this subject has not been discussed among current energy security academic literature and as such requires further investigation.

Shia/Sunni divide

As mentioned earlier the 'Arab Spring' revolutions took place after the study was performed. The Sunni/Shia divide was gaining prominence due to the continuing violence in Iraq. The threat to the KSA oil supply chain may appear vicarious but the growing prominence of inter (Muslim) sect unrest has increasingly become politically complex in nature. For the sake of this study the Sunni/Shia divide has shifted from being a discontinuation of the previously relative peace to an ongoing, politico-religious continuation. In further study the Sunni/Shia divide would be better placed in such a context where the perceived threat the divide holds could be better measured against the Saudi oil supply chain.

Forming a posterior distribution

The initial prior distribution contained eight risk factors that were each tested against sixty five perceived threats of varying impact, consequence, probability and likelihood. Improbable and imbalanced threats were discounted as were threats that no longer realistically exist. The scores were plotted on individual graphs and analysed.

During the analysis process it was discovered that some threats were duplicated and would be best absorbed or merged together into the common origin of the threat. The data regarding realistic threats that have a low, medium or high likelihood of impacting on the KSA oil supply chain were tabulated at the end of the analysis of each of the eight risk factors. The category, be it political or technology etc., was applied to determine the social 'driver' behind the threat. The Posterior Distribution Threat Table (below) displays all the threats identified in the Prior Distribution Threat Table except duplicated threats that have been merged or absorbed into four or the original eight risk factors.

Risk factors	Threat	Impact	Consequence	Probability	Likelihood
Saudi instability **(Political)**	Recruitment of terrorists **(Demographic)**	Low/Medium	Medium/High	High	High
	Politico-religious policies **(Politico-religious)**	Low	Medium	High	High
	Acts of terrorism **(Political)**	Medium/High	Medium/High	High	High
Iranians at a geopolitical premium **(Political)**	Nuclear programme **(Political)**	High	High	?	High
	Closure of the Strait of Hormuz **(Political)**	High	High	High	?
Double hull tankers **(Technology)**	Resilience of design during combat **(Technology)**	?	?	?	High
Western technology **(Technology)**	Is Chinese technology able to replace Western technology **(Technology)**	?	?	?	High

Fig 4.24 Posterior distribution threat table

Overall the success of the assessment cannot be understated. The results have not produced unsubstantiated assumptions or implied threats that scatter reason. The results have instead produced a clear, realistic and focussed posterior distribution that is in line with current academic discussion regarding threats to the region. More importantly the assessment has exposed perceived threats to two new areas, double hull tankers and oil field technology that are not represented in current literature.

Given the role that double hull tankers and oil field technology play in the KSA oil supply chain it is of key importance that these two areas are examined in greater depth in the final prior distribution assessment. Data from all areas of the posterior distribution table will therefore be carried forward to assist in forming the final prior distribution to determine risk to the KSA supply chain.

Chapter 5

Final Prior Distribution

In this chapter the posterior distribution generated in Chapter 4 will be reconstituted to form the final prior distribution. A new data collecting design will also be introduced. The new design will switch attention away from amassing data and focus instead on drafting prior distribution questions that when answered in Chapter 6 will reveal the likelihood of a threat materializing and where appropriate the extent of the disruption to the KSA oil supply chain.

Reducing unnecessary data

In order to reduce the amount of unnecessary data generated during the first prior distribution a new empirical stage design will be constructed (see fig 5.1: research framework below).[246]

Literature **Theory**
↓ ↓
Research area → Topic → Questions → Hypotheses → | Design → Data collection → Data analysis → Test hypotheses
↑
Context

Pre-empirical stage ***Empirical stage***

Fig 5.1 Research framework

In order to arrive at the results in the first posterior distribution, 65 perceived threats were measured against 3 variables (impact, consequence, probability) against each of 8 risk factors producing a total of 1560 measurements. This method produced a great deal of data to analyse which also included a large number of improbable threats. As the previous assessment revealed all manner of threats are probable although far fewer are likely to materialise.

[246] Punch, Keith F, *Introduction to Social Research Quantitative and Qualitative Approaches (Second Edition),* Sage, London, 2005, p. 40.

New empirical stage design

The data collection design in Chapter 4 concedes to the point that the risk factors in the first prior distribution were static in that they did not apply specific questions for the enquiry to produce relative data. Instead the assessment amassed both specific and a large amount of unnecessary data.

PRIOR DISTRIBUTION → LIKELYHOOD → LOSS FUNCTION

The empirical research design (above)[247] will assign appropriate questions to the six prior distribution risk factors. The questions will be specific to the threats identified in Chapter 4. The 'likelihood' of the threats materializing and 'loss function' if the threats are executed will be determined in Chapter 6.

Reconstituting the posterior distribution into the final prior distribution

The first assessment produced four out of the original eight risk factors that will assist in forming the second prior distribution. The assessment did produce a set of robust results but the exercise also identified that some risks, Spare Production Capacity and US-Saudi oil dependency, were not specific enough to the supply chain to produce advantageous results and have therefore been removed.

The process of reconstituting the posterior distribution into the final prior distribution is described from left to right in the table below. The four remaining risk factors are listed in the left hand column. On the right are listed the perceived threats to the risk factor. The third column lists any action to be taken regarding reconstituting the posterior risk into the final prior distribution. The final column contains a list of the final prior distribution risk factors. A detailed commentary beneath each table explains the logic behind the reconstitution process.

[247] Taken from within text Alexander, Carol, *Market Risk Analysis – Value at Risk Models,* John Wiley and Sons, Chichester, 2008, p. 375.

FORMING THE SECOND PRIOR DISTRIBUTION			
Risk factor	Threats	Action	Final Prior Distribution
Saudi instability **(Political)**	Recruitment of terrorists **(Demographic)**	Divide the original risk factor into two new relevant risk factors	Terrorism
	Politico-religious policies **(Politico-religious)**		
	Acts of terrorism **(Political)**		Instability within the KSA

Fig 5.2 Forming the Second Prior Distribution: Saudi instability if terrorism increases

In the first instance it is apparent that despite the results the risk factor was too broad a subject. The risk factor contains two elements, terrorism and instability of the KSA. A more satisfactory approach would be to create two new prior distribution risk factors that could challenge the KSA oil supply chain.

The first new risk factor, fig. 5.2, will centre on the likelihood of terrorism disrupting the KSA oil infrastructure. [248] The second new risk factor will centre on the likelihood of domestic instability within the KSA disrupting the supply chain[249]. As mentioned earlier, the thesis was researched just as the 'Arab Spring'[250] revolutions spread through the Middle East. With this in mind the thesis would be incomplete without the risk of domestic instability within the KSA being analysed.

The inclusion of domestic instability in the KSA as a risk factor came as a direct result of the impact the 'Arab Spring' revolutions had on the Arab world. The 'Arab Spring'

[248] Al-Ahmed, Ali, Bond, Andrew, Morillo, Daniel, *Security Threats to Saudi Arabia's Oil Infrastructure,*http://www.gulfinstitute.org/wp-content/uploads/2013/11/Threats_to_the_Saudi_Oil_Infrastructure.pdf
[249] Cordesman, Anthony, *Understanding Saudi Stability and Instability in a very different Nation,* CSIS,https://www.csis.org/analysis/understanding-saudi-stability-and-instability-very-different-nation
[250] Cordesman, Anthony, *Rethinking the Arab Spring,* CSIS, https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/111102_MENA_Stability_Security.pdf

was a distant unprecedented event when research began on this thesis. However, even though the timing of the 'Arab Spring' coincided with ongoing research, Bayesian methodology invites the inclusion of sudden new or additional risk factors in the problem solving process. In this respect the thesis benefitted from a methodology that can adapt to an ever changing set of events. Placing domestic instability in the final prior distribution is a logical and highly relevant risk factor to consider.

The two new risk factors complement one another and provide room for the threats of terrorist recruitment, acts of terror and politico religious policies to be discussed among industrial and social settings. The inclusion of instability with the KSA will also give room to examine the extent to which the Sunni/Shia divide could challenge the supply chain. A further point is that so far the prior distribution is only represented by political and technology driven risks. The addition of instability to the KSA will include data on how Saudi society could challenge the oil supply chain.

Risk factor	Threats	Action	Final Prior Distribution
Iranians at a geopolitical premium **(Political)**	Nuclear programme **(Political)**	The closure of the Strait of Hormuz would cause the greatest disruption to the KSA oil supply chain	Strait of Hormuz
	Closure of the Strait of Hormuz **(Political)**		

Fig 5.3 Forming the Second Prior Distribution: Iranians at a geopolitical premium

Tehran's nuclear program is yet to confirm whether a weapon has been successfully developed. However the likelihood is that the program will succeed. In regard to Tehran closing the Strait of Hormuz, the likelihood is unknown. Firstly because Tehran has threatened to close the Strait on numerous occasions in the past but never executed the threat. Secondly because any future decision to close the Strait may

depend on the development of a nuclear weapon which is likely to enhance Tehran's posturing.

In the new prior distribution, fig. 5.3, the two threats will be subsumed. Furthermore, when Tehran develops a nuclear weapon it will increase Iran's geopolitical influence. The most obvious threat Iran poses to the KSA supply chain is the possibility that Tehran will close the Strait of Hormuz. This being the case, as shown in the table the Strait of Hormuz would be a more relevant risk factor to analyse in the second prior distribution.

Risk factor	Threat	Action	Final Prior Distribution
Double hull tankers **(Technology)**	Resilience of design during combat **(Technology)**	Bring forward	Double hull tankers

Fig 5.4 Forming the Second Prior Distribution: Double hull tankers

In the first assessment double hull tankers were seen to be challenged by the external threat of combat and the structural threat regarding their resilience. When forming the posterior distribution it became clear that the key question of loss function lay with the resilience of the design.

As data already exists regarding the resilience of single hull tankers the severity of the loss function rests on whether the likelihood of the structure of a double hull tanker is less than that of a single hull tanker. If, as displayed in fig 5.4, a double hull tanker proves to be just as resilient, or more resilient, than a single hull tanker the loss function will be either potentially the same as or less than that of a single hull tanker. Not only is this measurement important to the shipping industry but the outcome could also affect insurance rates during times of heightened tension in the Gulf.

Risk factor	Threat	Action	Final Prior Distribution
Western Technology **(Technology)**	Chinese technology **(Technology)**	Bring forward	US and European oil industry technology

Fig 5.5 Forming the Second Prior Distribution: Western Technology

The reason why this risk factor remains is outlined above in fig 5.5 and earlier in more detail in Chapter 4. China has been quite aggressive at acquiring its market share of home produced goods and services. Former US Ambassador to Saudi Arabia stated since 9/11 'Aramco is now sending most of its trainees to countries other than the US.'[251] Oil field goods and services are key to production therefore the evaluation of Chinese products in this market is crucial.

	Threats	Action	Final Prior Distribution
	Politico-religious policies **(Politico-religious)**	Introduce Ex-pats to the prior distribution	Ex-pats
	Chinese technology **(Technology)**		
	Acts of terrorism **(Political)**		

Fig 5.6 Forming the Second Prior Distribution: Introducing Ex-pat workers

The final prior distribution, fig 5.6, will also include ex-pat workers. Ex-pats were mentioned by many of the interviewees in Chapter 4. Saudi Arabia has a huge ex-pat

[251] McPherson, Hugo, et al, *Emerging Threats to Energy Security and Stability,* Springer, Dordrecht, 2005, p.120.

and migrant worker population. The ex-pats fill a variety of roles from senior management positions to domestic help. They are separated from the domestic Saudi population but collectively play a key role in Saudi society. However, ex-pats are at risk to cultural, technological and terrorist threats. The Introduction of ex-pat workers into the prior distribution will allow analysis as to whether the actions of ex-pats could in any way disrupt the KSA oil supply chain.

Refocusing the prior distribution

Even when specific questions are applied it may be that the true magnitude of the threat cannot be identified because the threat is emerging, lacks data or carries a stigma such as 'it will never happen'. In this situation the likelihood of a threat materializing is either unknown in the case of emerging or data deficient threats, or inconceivable in the case of threats that are discounted on the basis that 'it will never happen'.

Analysis of the data in Chapter 4 identified that the emotive nature of implied threats can impair judgement. In situations where 'it will never happen' are applied to threats the prognosis is equally guilty of prejudgement. The stigma of prejudgement can often become a norm in that it becomes accepted practice not to explore the consequences of an event if it *did* happen. The consequences of challenging and breaking prejudged norms are well known to society through the process of law. Legal challenges to ending racial segregation and legalizing abortion are two examples where pre-existing norms were judged to be unlawful and overturned. In such cases the net effect of overturning the norm is not held in the question 'Will the case be won?' Instead the net effect is held in the unprecedented judgement 'If the case is won – how will the outcome change society?'

It will never happen!

In respect to the thesis there appears to be a stigma of disbelief attached to the closure of the Strait of Hormuz. The lack of existing data discussing the net effect if the Straits were to close points towards the closure of the Straits of Hormuz as being inconceivable. Disbelief that the Straits will close has become an established 'norm'

that has resulted in scant regard to calculating the consequences *if* the Straits were to close. Inconceivability can be linked to rhetoric. The inconceivability of the Straits of Hormuz ever closing may stem from Iran's repeated threats to close the Strait which never materialize. However, when a new threat is introduced, in this case the threat of nuclear arms, the continuity of Iran's arsenal consisting of conventional weapons alone ends. The situation requires re-evaluation. For this reason, in order to evaluate the overall risk the data collection process will not only ask 'will' a threat materialise, because it may already have materialised, but where appropriate also enquire 'if' the threat became more prominent or *did* materialize what would be the loss?

Cross referencing data

A further observation of the results reveals that several of the risks could impact upon one another. For example terrorism could impact on double hull tankers, as would the closure of the Strait of Hormuz. The final prior distribution would benefit from a cross referencing exercise. The first prior distribution contained too many risks and variables for a cross reference exercise to take place because the system of data collection was too complex.

The cross referencing exercise will assist in establishing significant prior distribution questions by removing unnecessary data and determining whether any of the six risk factors could impact on each other. Cross referencing will take place in two stages, firstly the question 'will' is asked, in that will one risk factor affect another and secondly the 'if' question, in that if it does then what will be the loss function. In order to track the development of the cross-referencing exercise the risk factors have been colour coded. The process is explained below.

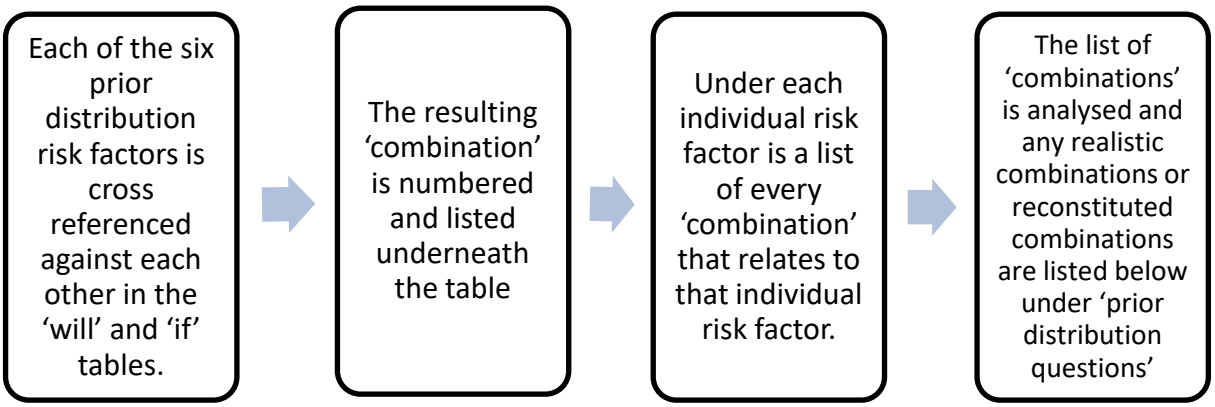


Fig 5.7 Cross referencing risks process diagram

Fig 5.8 CROSS REFERENCING TABLE ASKING 'WILL'

WILL	US and European oil industry technology	KSA instability	Strait of Hormuz	Double-hulled	Terrorism	Ex-pats
US and European oil industry technology	-	4	8	-	14	18
KSA instability	1	-	9	-	15	19
Strait of Hormuz	-	5	-	13	-	20
Double-hulled	-	-	10	-	16	-
Terrorism	2	6	11	-	-	21
Ex-pats	3	7	12	-	17	-

‘Will’ Combinations

1. Will the endurance of US and European oil field technology cause instability in the KSA?
2. Will US and European oil field dominance and technology in Aramco become a target for terrorists?
3. Will ex-pat workers be safe working with US and European oil field technology in Aramco?
4. Will domestic instability in the KSA affect the endurance of US and European oil technology in Aramco?
5. Will domestic instability in the KSA be cause for Iran to close the Strait of Hormuz?
6. Will domestic instability in the KSA cause terrorists to attack the oil infrastructure?
7. Will domestic instability in the KSA threaten the safety of ex-pat oil workers?
8. Will the closure of the Straits of Hormuz affect the endurance of US and European oil field dominance and technology in Aramco?
9. Will the closure of the Straits of Hormuz cause instability in the KSA?
10. Will the closure of the Straits of Hormuz be a threat to the safety of double-hulled oil tankers?
11. Will the closure of the Straits of Hormuz result in an increase in terrorism aimed at the oil infrastructure?
12. Will the closure of the Straits of Hormuz threaten the safety of ex-pat oil workers?
13. Will the new design of double-hulled tankers cause Iran to close the Straits of Hormuz?
14. Will terrorism aimed at the oil infrastructure affect the endurance of US and European oil field dominance and technology in Aramco?
15. Will terrorism cause instability in the KSA?
16. Will terrorists target oil tankers in the Strait of Hormuz?
17. Will terrorists continue to threaten the safety of ex-pat oil workers?
18. Will the continued presence of ex-pat oil workers ensure the endurance of US and European oil field technology in Aramco?
19. Will the safety of ex-pats continue to be a cause for concern in Aramco?
20. Will the presence of ex-pat oil workers in the KSA result in Iran closing the Strait of Hormuz?
21. Will the presence of ex-pat oil workers in the KSA be responsible for a rise in terrorism aimed at the oil infrastructure?

Fig 5.9 CROSS REFERENCING TABLE ASKING 'IF'

IF	US and European oil industry technology	KSA instability	Strait of Hormuz	Double-hulled	Terrorism	Ex-pats
US and European oil industry technology	-	26	30	-	-	40
KSA instability	22	-	31	-	37	41
Strait of Hormuz	23	27	-	35	38	-
Double-hulled	-	-	32	-	-	-
Terrorism	24	28	33	36	-	42
Ex-pats	25	29	34	-	39	-

‘If’ Combinations

22. If US and European oil industry technology endures at Aramco, will its presence contribute towards instability in the KSA?
23. If US and European oil industry technology endures at Aramco, could its presence be a contributing factor towards Iran closing the Strait of Hormuz?
24. If US and European oil industry technology endures at Aramco, will the presence of this technology result in an increase in terrorist attacks?
25. If US and European oil industry technology endures at Aramco, will the lives of ex-pats be any safer?
26. If the KSA becomes more unstable, will US and European oil industry technology endure at Aramco?
27. If the KSA becomes more unstable, will Iran close the Straits of Hormuz?
28. If the KSA becomes more unstable, will terrorism aimed at the oil infrastructure increase?
29. If the KSA becomes more unstable, will ex-pats be safe?
30. If Iran closed the Strait of Hormuz, will US and European oil field technology endure at Aramco?
31. If Iran closed the Strait of Hormuz, will the closure be a cause for concern at Aramco?
32. If Iran closed the Strait of Hormuz, will double-hulled tankers be a possible target?
33. If Iran closed the Strait of Hormuz, will terrorism aimed at the oil infrastructure increase?
34. If Iran closed the Strait of Hormuz, will Saudi based ex-pats be safe?
35. If double-hulled tankers are more susceptible to damage than single hulled tankers, will this knowledge prompt Iran to close the Strait of Hormuz?
36. If double-hulled tankers are more susceptible to damage than single hulled tankers, will this knowledge prompt terrorists to attack them?
37. If terrorism aimed at the oil infrastructure increases, will the attacks cause instability in the KSA?
38. If terrorism aimed at the oil infrastructure increases, will the attacks prompt Iran to close the Strait of Hormuz?
39. If terrorism aimed at the oil infrastructure increases, will the safety of ex-pats be affected?
40. If the safety of ex-pats is not assured, will US and European oil industry technology endure at Aramco?
41. If the safety of ex-pats cannot be assured, will their situation become a concern for Aramco?
42. If the safety of ex-pats cannot be assured, will terrorist attacks on the oil infrastructure increase?

Summary of prior distribution questions

Analysis of the summary prior distribution questions reveals that a number of questions need to be reassigned to more appropriate risk factors.

US and European oil industry technology prior distribution questions

1. If Aramco introduced Chinese technology will production suffer?

2. If Iran closed the Strait of Hormuz, how will the closure affect Saudi Aramco's operations? (move to Strait of Hormuz)

KSA instability prior distribution questions

3. Will ex-pats cause friction among the Saudi people? (move to ex-pats)

4. If terrorism in Saudi Arabia increased, would Saudi Security Forces have the capability to protect the oil infrastructure and oil industry ex-pat personnel from attack? (move to terrorism)

5. If ex-pat Aramco employees fled Saudi Arabia, would Aramco be able to operate without them? (move to ex-pats)

6. Will the presence of ex-pat oil workers in Saudi Arabia cause an increase in acts of terrorism aimed at Aramco and the wider oil infrastructure? (move to ex-pats)

Strait of Hormuz prior distribution questions

7. Will Iran close the Strait of Hormuz?

8. If Iran closes the Strait of Hormuz will this affect tanker traffic?

Double-hulled oil tankers prior distribution questions

9. Will double-hulled tankers be more susceptible to damage than single hulled tankers?

10. If double-hulled tankers are more susceptible to damage than single hulled tankers, will this knowledge prompt Iran and/or terrorists to attack them?

Terrorism prior distribution questions

11. If terrorists discover that double-hulled tankers are more susceptible to damage than single hulled tankers, will attacks against double-hulled tankers increase?

Ex-pats prior distribution questions

12. If Saudization continues will the project result in a decrease in the number of Saudi based ex-pat oil industry employees?

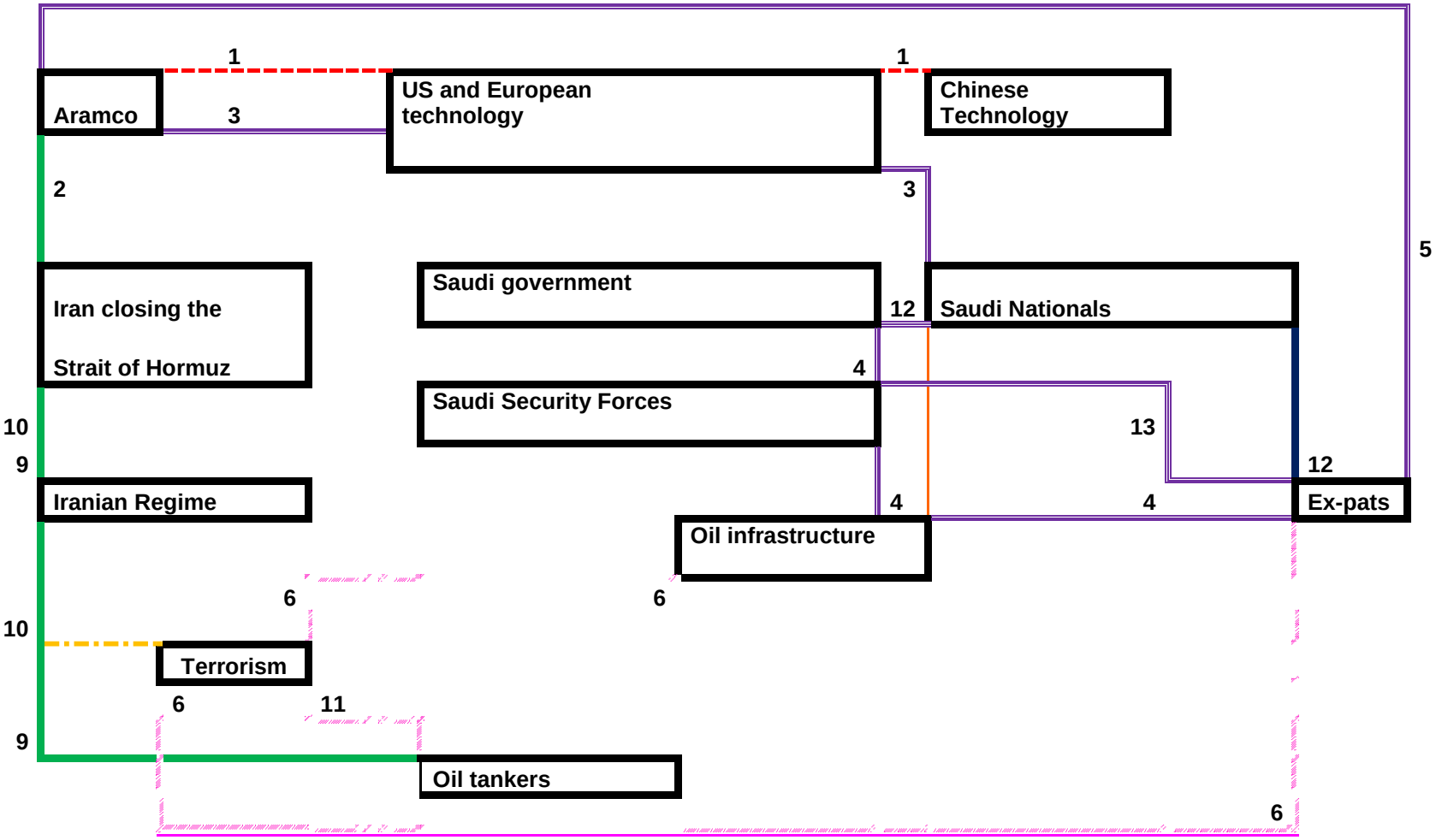
13. If the Saudi government cannot assure the safety of ex-pat oil workers, will they leave their posts?

<u>Re-assigned prior distribution questions</u>

The list of reassigned prior distribution questions below will form the basis for collecting data on the six risk factors for analysis in Chapter 6. The diagram (below) depicts the inter-connections between the risk factors. The diagram is colour coded so the connections between risk factors can be tracked. The numbers assigned to each connection refers to the prior distribution question number.

The recently introduced risk factor of instability within the KSA is left without any prior distribution questions. Although fundamental drivers for KSA internal stability, the Saudi government, security forces and people are connected to other risk factors, the drivers are not pitched against each other. This being the case suitable questions will be constituted to determine precisely which threats could cause instability within the KSA.

Fig 5.10 Risk factor interconnection diagram



US and European oil industry technology prior distribution questions

1. If Aramco introduced Chinese technology will production suffer?

KSA instability prior distribution questions

Strait of Hormuz prior distribution questions

7 Will Iran close the Strait of Hormuz?

8 If Iran closes the Strait of Hormuz will this affect tanker traffic?

2. If Iran closed the Strait of Hormuz, how will the closure affect Saudi Aramco's operations?

Double-hulled oil tankers prior distribution questions

9 Will double-hulled tankers be more susceptible to damage than single hulled tankers?

10 If double-hulled tankers are more susceptible to damage than single hulled tankers, will this knowledge prompt Iran and/or terrorists to attack them?

Terrorism prior distribution questions

11 If terrorists discover that double-hulled tankers are more susceptible to damage than single hulled tankers, will attacks against double-hulled tankers increase?

1. If terrorism in Saudi Arabia increased, would Saudi Security Forces have the capability to protect the oil infrastructure and oil industry ex-pat personnel from attack?

Ex-pats prior distribution questions

3 Will ex-pats cause friction among the Saudi people?

13 If the Saudi government cannot assure the safety of ex-pat oil workers, will they leave their posts?

6 Will the presence of ex-pat oil workers in Saudi Arabia cause an increase in acts of terrorism aimed at Aramco and the wider oil infrastructure?

2. If ex-pat Aramco employees fled Saudi Arabia, would Aramco be able to operate without them?

12 If Saudization continues will the project result in a decrease in the number of Saudi based ex-pat oil industry employees?

Assigning prior distribution questions to instability in the KSA affecting the oil supply chain

Past and current literature has repeatedly questioned the stability of Saudi Arabia from a political, economic and societal perspective. Visceral threats to internal stability range from the actions of the Royal family, the effect of reforms, terrorism, the economy, fundamentalism, young people, unemployment, Sunni/Shia sectarian conflict, instability among regional neighbours and pressure from foreign powers. Whereas any number of these examples could affect the KSA oil supply chain, some would have a greater affect than others. The sequence of 'events' will also register in that some threats require a build-up of events in order to become potent threats. As the threat connection diagram highlights, threats are often interconnected adding yet more possibilities.

When defining prior distribution questions the process has focussed on key threats to the physical supply chain. Given that the threat of terrorism and ex-pat workers are standalone risk factors, instability within Saudi Arabia would be expected to come from the actions of the government, the economy or the Saudi population. Recent events captured during the 'Arab Spring' revolutions have catalogued the component parts which led to instability and regime change among the Arab world. A broad analysis would suggest that Arab Spring revolutions succeeded in countries where the ruling party, or family, took ownership of the army and the

economy, thus creating a system that prevented development of and among the population[252].

Supplementary questions

If the concept above is applied to Saudi Arabia the risk factors would comprise of actions of the Saudi government, economic and welfare reforms and the actions of young people. Due to the strategic geopolitical position of Saudi Arabia a fourth risk factor would be the actions of the United States. These four risks provide headings under which instability will be analysed. Each of the four risks will require a number of supplementary questions to determine the scope and impact of the risk. Underneath each risk factor are examples, although not exhaustive, of supplementary questions that will determine the extent of the threats to the instability of the KSA.

Will the policies of the KSA government cause insatiability in the KSA?

- Is instability in the KSA a result of market competition in as much as it is a result of internal politics or outside interference?
- Is it not the case that the KSA need customers with dynamic economies which cause fluctuations and therefore competition within the market?

Will economic and welfare reforms cause instability in the KSA?

- Do reforms discriminate between the Sunni and Shia faith?
- Do reforms promote entrepreneurship?
- How deeply entrenched is the Saudi Royal family in running Saudi businesses?
- To what extent are the Saudi people reliant on welfare to sustain their lifestyle?

[252] Cordesman, Anthony, *Rethinking the Arab Spring,* CSIS, https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/111102_MENA_Stability_Security.pdf

Will the actions of the younger generation cause instability in the KSA?

- What are the expectations of the young?
- Do they differ among the Shia and Sunni population?
- How do the uneducated pass their time?
- What percentage attends university in their home country?
- Are university degrees in tune with private sector employment vacancies?
- Does public sector employment encourage development?
- Is working in the public sector an introduction to corruption?
- Do the uneducated take their faith seriously?
- Do the educated take their faith seriously?
- Is unrest expected to originate from the uneducated or educated young?
- Are Al-Qaeda seen as hero's
- Is the US seen as an enemy?
- Do the younger generation see themselves as replacements for today's ex-pat workforce?
- Is oil seen as a curse?
- Is there a coherent strategy in place if women were admitted into the workplace?
- Would employing women upset the younger generation?
- Can fundamentalism and free speech exist together?
- Is the link between fundamentalism and terrorism over emphasised?

Will the actions of the USA cause instability in the KSA?

- Is the supply chain any more or less at risk than it was prior to 9/11?

Chapter 6

Technology

The above research question is analysed with a combination of historical and current data[254]. Two historical case studies are presented, the building of the Trans Arabian Pipeline 'Tapline' and the Al-Awda project to extinguish the Kuwait oil fires. The two case studies not only detail the commitment US companies have in Saudi Arabia and other Gulf producer states but also explain how the discovery of oil in Saudi Arabia gave Washington an opportunity to spread its hegemony to the region. Tapline underscores the harder geopolitical and geo-economic aspects of hegemony backed up by the softer principles of culture and social interaction involved in the Al-Awda project. Core to both case studies is the security afforded to the inter dollar relationship between the US and Saudi Arabia. The third section reveals the attitude of oil industry personnel towards the recent introduction of China as a competitor in the Saudi oil market by way of candid interviews and commentary gathered at a recent oil and gas exhibition in Saudi Arabia.

The Trans-Arabian Pipeline

The first case study exemplifies how American technology extended US hegemony to Saudi Arabia and the greater Middle East. The US enshrined its commitment to Saudi oil with the construction of the Trans-Arabian Pipeline. The importance of Tapline cannot be understated. It was built to underpin Western Europe's political and economic security set against the Soviet Bloc via the US funded Marshall Plan.[255] At the time of construction Tapline was the largest engineering project in the world. The project was funded by the US based Aramco consortium with full backing and cooperation from Washington. The line was to be built between Abqaiq in KSA to the export terminal at the Lebanese port of Sidon, a distance of 1,040 miles.[256] Pumping oil overland saved small post war tankers a 7,200 mile journey round trip through the Suez Canal to the Persian Gulf, which would have made the cost of transportation

[254] Current data is taken from interviews conducted at the 2008 SAOGE. See Field Trip in Chapter 5. Full text of interviews in the appendices.
[255] Yergin, Daniel, *op cit, p.* 407.
[256] Yergin, Daniel, *ibid, p.* 408.

higher than the price of the cargo. Although constructing Tapline proved to be a mammoth logistical task in itself, Aramco/Washington had to deal with succession of complex geopolitical problems which jeopardised the lines completion.[257]

Construction

Plans for Tapline were finalised in 1946. One of the major obstacles to overcome was a shortage of steel plate which was under US government control.[258] The Saudi infrastructure was so underdeveloped that the Kingdom did not possess a deep water port to unload the steel pipes in. Bechtel Engineering, the company tasked with building the pipeline had to construct an offshore 'Skyhook' in order to transfer the pipes and other equipment to the shore.[259] The interior was no different. Tapline stretched north along the remote eastern side of Saudi well away from the capital Riyadh in the west. A service road was built alongside the pipeline which reached previously isolated Shia Bedouin communities and eventually linked the Jordanian capital Amman with Dammam, Kuwait and Bahrain therefore providing a key trade route. Due to the sheer size of the project, landing strips had to be built for spotter planes to carry surveyors. These strips were eventually turned into domestic and military airports making the Kingdom far more accessible and manageable for the Royal family to begin shaping modern Saudi society.

The project also provided employment for Saudi nationals, introduced skills and new technology to a region previously reliant on the bare necessities of life. Construction camps contained medics, shops, fresh water and American goods which were accessed and traded with locals. As projects went, Tapline became more than just the laying of a pipe. It provided a foundation on which the US extended its hegemony over the region by way of introducing the 'American way' to an impressionable Saudi Arabia. The project's success however eventually commanded a heavy price for both parties. By the time of Tapline's completion in 1950 the pipeline had already become a geopolitical rash through the desert.

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[257] Namely Israel. For a detailed account see Yergin, Daniel. *Ibid,* p. 393.
[258] Yergin, Daniel, *ibid,* p. 393.
[259] http://almashriq.hiof.no/lebanon/300/380/388/Tapline/building-Tapline/building-Tapline.pdf 20/05/2009.

Geopolitical issues

The tense and frustrating aspects of co-dependency regarding the Saudi-US joint venture are nowhere better displayed than during the creation of Israel. At their historic meeting in 1945 on Egypt's Great Bitter Lake, Saudi King Ibn Saud made it obvious to President Roosevelt that a Jewish homeland would cause friction in the Middle East.[260] The discovery of oil in the Kingdom was incentive enough to overcome a difference of opinion over Israel, but in reality the arrangement was to prove an oscillating blessing and a curse - at different times – for both Riyadh and Washington with the oil industry firmly entrenched in the middle.

The construction of Tapline was well underway when the US supported and recognised the Jewish State of Israel. The birth of Israel however required Tapline to be diverted away from its original planned export terminal at Haifa, north into Lebanon, but with so much at stake for Washington re-routing the pipeline was seen as nothing more than an occupational hazard. Despite his enormous dislike for Israel Ibn Saud gave in to the self-fulfilling nature of the grand design and declared that oil royalties would help make Saudi 'a stronger and more powerful nation.'[261] A sentiment that his descendants have also pitched when challenged, much to the chagrin of Saudi's Arab neighbours.

The vexed issue of transit fees added further grist to the mill. Syria began demanding ever increasing charges for Tapline to cross its sovereign territory. Relations with Jordan became further aggrieved. Not only did the House of Saud have Amman to contend with over Israel and Palestine, but the Jordanian Royal family the Hashemite's, were backed by Britain as the true defenders of the faith which was an ongoing cause of friction with Riyadh. It came as no surprise therefore after Syria's demands when Amman too began arguing over transit taxes even before the pipeline crossed the Jordanian border.[262]

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[260] Yergin, Daniel, *op cit,* p.385-387.
[261] Yergin, Daniel, *ibid,* p. 387.
[262] Stevens, Paul, *Pipelines or pipe dreams? Lessons from the history of Arab transit pipelines,* Middle East Journal, Vol. 54, Issue 2, Spring 2000, p. 224.

Syria and Jordan had been deeply affected by the creation of Israel. They were firmly against US involvement in the region and due to their geographic position and rising importance as transit states, commanded mounting support from other anti-Zionist Arab nations. Washington found itself in the unenviable position of having to negotiate highly favourable terms with acrimonious governments in order to keep the project alive. Conversely Riyadh had to be seen to disagree with current US policy towards Israel and the larger Middle East while at the same time reassuring, i) neighbouring states that Saudi was doing all it could to confront the US over its support of Israel and, ii) Washington that it would not do anything drastic enough to upset the highly lucrative *status quo.*

The Truman administration viewed Tapline as an essential instrument in the success of the Marshall Plan by which Saudi oil would fuel the recovery of Europe[263]. Saudi on the other hand were ideally placed to benefit from the dollars paid in royalties by Aramco to buy American goods and services, while at the same time affirming their place as the rising power in the Gulf.

Tapline could only strengthen the dollar as the world's reserve currency, Tapline's implementation provided mutual wealth to cooperating states; it's construction encouraged foreign investment in private US based companies, technology transfer and social assistance, all for a common goal. It was under those terms that Saudi became key to US foreign policy and along with it America began exporting, installing and running the Saudi oil infrastructure under the close protection of Washington and the recently built Pentagon.

The Al-Awda Project: the Kuwait oil fires

The second case study concerns the use of US technology when things go wrong. Although the case study does not originate from Saudi Arabia the US technology and expertise used in the Al-Awda project serves as a reminder to Riyadh that if ever required, private American companies could rescue their oil fields and put the wells

[263] Yergin, Daniel, *Op cit,* p. 406.

back into production.[264] In 1991 the retreating Iraqi army destroyed and ignited Kuwait's oil wells. Whereas there had been plans for armies to capture oil fields intact, as advanced by Henry Kissinger to US President Nixon in 1973[265], this was the first time fields had been seized and rendered unusable. The aim being that the host country would stop receiving any dollar revenue from the export of their oil. The amount of revenue lost could therefore potentially weaken the wider dollar.

Putting out the fires

Iraqi troops sabotaged the wells by placing shaped charges on the capping valves or 'trees' so the blast would shear the tree and ignite the pressurised crude as it escaped.[266] There is one important fact that was suppressed by the subsequent media coverage of the environmental catastrophe. The Kuwait Oil Company 'KOC' had not fitted Blow Out Preventer's under the well heads in the Burgan field.[267] Under normal circumstances the Blow Out Preventer would shut down the flow of oil in the well when met by a sudden release in pressure. This oversight, calculated at a cost of two million dollars, contributed to a total loss of approximately six million barrels of oil.[268]

Bechtel Engineering was given the task of supporting an international team of fire fighters. The first consideration was to remove any mines and discarded ordnance from the area before the teams could begin work.[269] American teams extinguished 380 of the 727 burning wells in extremely dangerous conditions.[270] The heat from the burning wells turned surrounding oil into coke.[271] Huge parts of the desert had to be flooded with water and temporary roads were built to move heavy machinery. The strong desert wind compounded the hazardous situation by quickly changing direction and engulfing equipment in flames[272].

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[264] Details of the Al-Awda Project are, unless otherwise referenced, are drawn from Grace, Robert D, *Blowout and Well Control Handbook,* Gulf Professional Publishing, London, 2003, p. 418-465.
[265] Anon, *UK feared Americans would invade Gulf during 1973 oil crisis,* Guardian https://www.theguardian.com/politics/2004/jan/01/uk.past3
[266] Grace, Robert D, *Op cit,* p 422.
[267] Adelman, M. A, *The Genie out of the Bottle,* MIT Press, Cambridge, Massachusetts, 1995, p. 301.
[268] Adelman, M. A, *Ibid,* p. 301. p. 301.
[269] Grace, Robert D, *Op cit*, p. 418..
[270] Grace, Robert D, *Ibid,* p. 443.
[271] Grace, Robert D, *Ibid,* p. 422.
[272] Grace, Robert D, *Ibid,* p. 426.

Leading authorities predicted that it would take five years to extinguish the fires. The project was completed in 229 days[273] and its success can firmly be laid at the feet of the American's ability to not only mobilise support quickly but also their work ethic and contacts within the KOC.

Private –v- Public work ethic

Behind the success of the Al-Awda project lays a candid insight into the extent to which US dominance of oil industry technology has shaped and educated oil companies worldwide. One of the initial planners of the project was an academic Adel Sheshtawy from the University of Oklahoma.[274] Sheshtawy was contacted by a former Kuwaiti pupil who had risen up the ranks of KOC. Sheshtawy learned about concerns regarding the possible destruction of the Kuwait oil fields by Iraqi troops. KOC was in no position to deal with any subsequent fires itself, as Kuwait was in chaos.[275] Even so, the difference between KOC coordinating such a project and US and other private enterprises needs examining.

The US oil industry has always operated independently of the state although it's plain to see that Washington is heavily involved in creating diplomatic support for overseas projects. For example the US state department issued fire fighter Red Adair with a fake passport and logistical support so Adair could tackle a blaze on an offshore Egyptian platform during the Yom Kippur war. Adair later stated that he had to appeal to both Egyptian and Israeli gunboats that despite being a US citizen he was just doing a job for the common good.[276]

The service providers involved in the Al-Awda project had all built up significant respect within the industry. Their proven past records were partly due to the lack of constraints taking on work overseas. In the true spirit of capitalism service providers rewarded themselves, and in so doing could attract a highly experienced and loyal workforce. National oil companies tend to concentrate on their own 'patch' which

[273] Grace, Robert D, *Ibid,* p. 442.
[274] Grace, Robert D, *Ibid,* p. 447.
[275] Grace, Robert D, *Ibid,* p. 447.
[276] Adair, Red, *An American Hero, Little Brown and Co,* London, 1990, p. 288.

severely limits their knowledge base, as does the state policy in employing a high percentage of inexperienced nationals to fill managerial posts. Beneath this countenance flows another more subtle reason why American companies are so keen to tackle disruptions, particularly in the Middle East, in that it's in the interest of their own survival to do so.

The stability and net worth of the US dollar is cardinal to the growth of the US economy. The stability has an obvious effect on domestic and US industry worldwide. It is within the personal interest of US oil industry service providers to repair disruptions to supply so that oil can be once again be exported for dollars. In as much as the continuing flow of oil is important to America, so is the flow of money to produce a stable dollar – therefore maintaining a mutual cost effective relationship between state oil companies in the Gulf and US service providers. The price of oil rose from just under $20 dollars a barrel to over $30 a barrel after the wells were extinguished – the extra revenue no doubt helped pay for the loss of exports and the $700 million Kuwait paid Bechtel for the successful completion of the Al-Awda project.

The dominance of American goods and services in Middle East oil remained virtually unchallenged until 9/11. The attack by Al-Qaeda severely strained relations between Saudi and the US. Washington was very quick to repatriate Saudi nationals but for Saudi to do the same with US personnel would have left its oil industry floating adrift. American oil industry service providers were placed in a difficult position – on the one hand they had overnight become unwelcome guests, but on the other they were providing a vital service for Saudi's state run Aramco oil company and could not be dispatched for that reason. As Riyadh looked for a solution, 9/11 provided China with an opportunity to enter the Middle East not only as an oil importer but as a provider of goods and services to the Saudi oil industry.

Is a Chinese alternative to US technology a viable option for Aramco?

In 2008 I attended the Saudi Arabia Oil and Gas Exhibition in Dammam. My aim was to interview company representatives about their views on the recent arrival of China as a supplier of goods and services to Aramco. It became apparent, due to the sensitive nature of the questions I proposed to ask, that if I were to have a frank

discussion on the subject any interviewees would have to remain anonymous. I was also fortunate in that many of the reps wished to voice their opinion about China's entrance to the market.

I conducted five identical in depth interviews with representatives A, B, C, D and E. Reps A to D were all employed by US or European based Small/Medium Enterprises (SME) and were currently conducting between 10% and 40% of their total business in Saudi Arabia. The strength of their product lay in its design. Interviewee 'E' represented a European based global manufacturer which had a large fabrication plant already producing in China. A summary of their answers can be found in tabulated form in table (fig 1). During the interviews I had to take into account that my questions would be answered from the point of view of the endurance of their own products against Chinese competition and not existing western competitors.

I was able to introduce 'overall perspective' on the subject by interviewing the Operations Manager 'OM' of a major US oil field service provider to Aramco. 'OM' procured goods and services from the SME I interviewed. I was able to discuss my findings with OM about the impact of China on the industry as a whole. A brief summary from the table however reveals that concerns raised by representatives A to D revolved around the Chinese disregard for copyright laws, although it was universally held that working with the Chinese was a viable option in the future if the venture was regulated and controlled by western standards.

Industry Voices

My interviews were structured to reveal specific core issues and concerns. In the discussion below I will 'run through' these issues and concerns quoting directly from the interviewees as their answers reveal their reasoning, personal experiences and gauge the general mood of the industry they serve. Although some of their answers do detract away from the sole issue of China's disregard for Intellectual Property Rights (IP), these 'industry voices' reveal a great deal more about the US/European – Saudi – China triangle.

In order to state my case regarding the influx of Chinese products I pressed the example of cheap Japanese cars flooding the market in the 1970's, which soon gave the Japanese car industry enough capital to start designing quality models whose introduction eventually contributed to the near bankruptcy the US car industry. Interviewee C acknowledged the point

> **[Y]ou would hope that we would be able to learn from those lessons. I think the real lessons with the Japanese were that we didn't take them seriously in their ability to produce a quality product and so for years and years we ignored it, and if the same thing were to happen in China, I don't believe that we would ignore it nearly as long or I think we would take it more seriously.**

This impression was one held by the majority of representatives I spoke with. The primary issues did not centre on the introduction of the Chinese to the market but as clearly shown in the table it centred on the issue of China blatantly copying other company's products – the transfer of technology. Interviewee B summed up the situation

> **Yes I believe that they [the Chinese] have an official policy of technology transfer that's what I was told when I was there that they want to take western technology and bring it in the country and that's why they do not have laws against taking and stealing copyright and patents... Eventually China is going to come up with some of their own stuff and they're going to want that protected... I honestly don't blame them for the way they've been operating up till now, but I think it is time that they joined the rest of the world in supporting the patent laws, copyright laws and all the protections for people's technology 'cause I think they're going to, if they don't, they're going to have a more and more difficult time at becoming partners, nobody will trust them. So I think it's time that they changed their business model.**

The current Chinese business model not only affects products already on the shelf but impacts on research budgets and product development. Interviewee D

> **[I]t's really self-destructing because the more product that goes away to China, the less profit there is for R and D. So there comes a point where you have to make a distinct choice either more R and D and develop your products or risk going out of business.**

Interviewee A voiced the same concerns stating that 'we've got some specialist engineering services in the UK that supply the global oil and gas marketplace and I think it would be detrimental to the UK business if...certain aspects were to be taken out of the UK.' The wider implications of introducing copied or counterfeit products into the oil industry have a far greater impact than commercial loss. Representatives offered numerous examples where cheap counterfeit Chinese products had failed in the field causing enormous damage and downtime. However, the reporting of such incidents is often repressed in producer states. In such cases the cost margin between original and counterfeit cannot be justified. And because of the secrecy there is no sharing of information between producer states regarding counterfeit goods. The situation is summed up well by the following two comments.

Interviewee A

> **Well there's been a couple of incidences, one in particular was back in 1997 where I was working for a large well head company and we had several blow-outs in the Saudi Arabian marketplace that caused field fires and subsequently the Red Adair crew had to come in and assist by putting the fires out. The investigation took place and found out that there was non-OEM, original equipment manufactured products and seal equipment or components were being used in those blow-out preventers. Subsequently the investigation found that those products were being bought from China.**

Interviewee D

> **What we've seen over the last ten years is some very, very big accidents that by and large don't get reported. So whichever country you go into and there's some of these countries they just maintain radio silence, they're banned by governments from printing stuff. But we know within the industry what's happening and there's been some pretty horrific stories going around.**

Products, like service providers build up a reputation within the industry. Some counterfeit components replicated so well that it is almost impossible to tell the difference between the counterfeit and the original. But this is not always the case. One exasperated rep explained how Chinese copies of a component manufactured by Cameron Engineering, a well-established American company, were identical save for the fact that 'Cameron' was spelt with a 'K'. He later went on to state that in his opinion

‘I think it’s one of these things, the problem is so big, and the political or the economic environment drives it to a point it can’t be controlled.’ He further remarked that since many Chinese companies were now in private hands and making a profit, company directors wished to remain affluent and had a lifestyle to support. This contributed to the highly inventive methods Chinese companies adopted in order to market their products, including forging important paperwork. Interviewee D

> **We’ve had first hand experiences where we have had certificates of conformity stamped, witnessed by reputable bodies, these people have quality control certificates from quality organisations. And if you look on any website you’ll see the Chinese advertising they have all these quality standards and certificates but when you get it back into your factory and do an investigation, we’ve seen pieces with holes in them that could never have passed a pressure test where we have a certificate stamped and signed to say it did.**

Interviewee D also argued that lifestyle expectations also affected the behaviour of Chinese personnel working in the field

> **[A]s you travel around oil fields, you’ll see Chinese people everywhere. But again the difficulty that you find is they can work with Europeans no problem, they can learn how to do the job, but the difference is there is no loyalty, their whole culture is money driven and when you see the culture in China you understand why. But these guys will quite happily leave an oil field, leave a site and move within a week or two for a few hundred dollars a month.**

The consensus was that producer countries could do more to control the importation of counterfeit components from China rather than the accepted culture of turning a ‘blind eye’ to it. Interviewee C

> **I think it’s the responsibility of the producing states to actually try to make sure that the organisation that claims to be making it is actually making the product and that the dollars that are being spent actually go to the people who actually, who own the intellectual property and producing it. So they do have a responsibility to do that.**

So far, the comments have come from reps of SME’s. The same is not true from Interviewee E. Interviewee E represented a large global manufacturer, a ‘Blue chip’ company which had the capital to build and staff its own manufacturing plant in China.

[W]e just saw [China] as a big opportunity for us and we capitalised on that, putting up our own fabrication site there and we catered to the Chinese market first and now we're extending it to the other locations...we have our own procedures to qualify the mills from where we take our raw material...I would just like to make this point, China or any other Asian country for that matter, even India, we have good and bad companies like anywhere else in the world... we can go and do our own audits, our own test and random checks.

Interviewee E further explained that due to the size of their investment and the terms of the contract it was possible for their own standards to be met and worked to, which he acknowledged could probably not be enforced by SME's entering into joint ventures with small Chinese manufacturers.

Despite the colourful examples stated above when I asked reps to indicate the threat and risk of Chinese products entering the market their assessment was more pragmatic

Interviewee C

[A]t the moment it's a mild threat to a medium threat meaning there is concern in doing business directly with China.

Interviewee B

It's my impression that the low technology, high volume product manufacturing would be at risk, I don't see the one-offs and the very large items being something that would be a serious threat at this point of time in this industry.

Interviewee D

I think the main threat is going to be at the low end of the technology scale, I think the high end technology they're starting to learn that their products are being banned around the world because they are just not safe. So I think what we'll see is a development back to basics, they'll start I think trying to learn what to do, but how long does it take to change a culture? That's why I say I don't think I'll see it in my lifetime.

I put my responses to the Operations Manager (OM) of a major US oil field service provider working with Aramco. OM's analysis was far more direct and provident. Regarding IP theft and copying, OM argued that it really only affects the lower end of technology and so far talk of sanctions received no quarter from western governments who had too much to lose by frustrating relations with Beijing.

On the upper side, the Chinese are keen to enter the market but in order to meet existing standards, cooperating Western companies needed to 'shepherd' the Chinese to improve quality. The downside being that when a component did fail in the field it sent out a 'ripple effect' that affected reputations and future loss of sales. OM also stated that the manufacturing capability in China was massive and that any savings in this area offset the cost of failures in the field.

Finally OM advanced that in his opinion the industry was under greater threat from failures involving counterfeit Chinese products when oil was at 'high demand, high price, high requirements which equates to high risk' because this combination of market forces resulted in an increase of drilling and with it, a greater usage of components therefore increasing the probability of a failure.

Conclusion

From the evidence held above there does not appear to be any current or emerging threat towards the Saudi oil infrastructure large enough to prevent US and European technology dominating and enduring in the kingdom. The geopolitical and geo-economic ties between the parties are too strong to be overturned by China alone.

US and European technology is well grounded in the Saudi infrastructure for a number of reasons. Western suppliers have over the years built up trust and loyalty by providing competitive high quality components backed up by a fast and efficient service. The US 'business model' of facilitating private companies in their endeavours is almost diametrically opposite to the Chinese 'business model' of facilitating manufacturers in the infringement of copyright and exporting counterfeit goods. Given the stakes, it will be up to the Saudi customs to prevent the vast majority of counterfeit goods arriving in the field. But until the current trend of 'turning a blind eye', accidents, reported or not, will continue to place a question mark over the presence of China in the market. China could augment their position in time by cooperating with western companies and developing trusted brands.

The reality appears to be a simple one. The micro tenets acting against US and European technology surrounding downtime caused by the introduction of Chinese counterfeit components pale when compared to the macro policies Washington can impose on the region as the world's hegemon. Riyadh's enduring dependency on US goods and services, maintaining the Kingdom's oil infrastructure, has by default also made maintaining a stable dollar a priority in Saudi's best interest.

Saudi instability

Four main factors that challenge instability

In 2003 a NATO hosted seminar identified alienated young people, fundamentalism, pressure from the USA and political instability (regime change) as the four key problems facing Saudi Arabia.[277] A fifth precept is the lack of economic diversity. The seminar produced an accurate prediction as nearly a decade later these problems still remain principle in Saudi Arabia. Demographics have continued to be a socio-cultural pressure point. Approximately half of the Kingdom's population is under the age of 18.[278] Employment issues may also explain to some degree why Saudi struggles with economic diversity. But greater market forces are at work in this area.

In 2005 Saudi Arabia became the 149th member of the World Trade Organisation[279], a decision which impacted on the way business is conducted within the Kingdom – the scope of which will alter the dynamics of Saudi's small group of affluent merchant families.[280] The question of political instability must be addressed in light of the Arab Spring. The possibility of regime change in the Kingdom has proved a popular moot point with academics – but could the Arab Spring realistically spread to Saudi? Underpinning the above is the ongoing but somewhat abrasive relationship between Washington and Riyadh.

[277] McPherson, Hugo, et al, *Emerging Threats to Energy Security and Stability,* Springer, Dordrecht, 2005, p. 197-200.
[278] http://www.un.org/esa/population/meetings/egm-adolescents/roudi.pdf
[279] http://www.wto.org/english/thewto_e/acc_e/a1_arabie_saoudite_e.htm
[280] Niblock, Tim, *The Political Economy of Saudi Arabia,* Routledge, London, 2007, p. 110.

There are a number of less obvious issues that could eventually challenging Saudi's domestic stability such as the death of a monarch, exposure of further human rights abuses or policy shifts such as signing defence hardware contracts with China or Russia. So the issues are therefore not necessarily military/security threats but business or ethical in nature. The question remains, could political instability, a lack of economic diversity, demographic crisis and the expectation that US-Saudi relations will continue, pose a risk to the Kingdom's oil exports?

Demographic imbalance

Worryingly almost half of the Saudi population is under the age of eighteen. The future for these young people is decidedly uncertain. Mai Yamani, among others, argues that the phenomenal changes that have taken place in Saudi Arabia since the 1930's have implications for the political consciousness of young people that in the long term may result in threat to the Saudi regime.[281] Again space does not allow for an in depth study so discussion will be kept to the two main concerns, that of employment and the growth in fundamentalism. Rather than comment on employment and fundamentalism as two separate entities there is certainly a case which suggests that a rise in fundamentalism among young Saudi males may be a direct result of poor employment prospects.[282]

There are a number of contributing factors to the predicament young people face. Young people growing up during the 70's oil boom had a far better standard of living than their parents did.[283] The escalating expectations of the generations did not run in parallel with the economy, which had tailed off by the 1980's.[284] During this time young Saudi's cycling through education, employment and on to lifestyle expectations found themselves marooned. Although some of the blame is laid firmly at the feet of the individual, policy also adds to the impasse. Young Saudi's are accused of expecting managerial posts while the state stumbles on attracting investors to provide such posts.[285]

[281] Potter, Lawrence G, Sick, Gary G, *Security in the Persian Gulf,* Palgrave, London, p. 189.
[282] McPherson, Hugo, et al, *Op cit*, p. 199.
[283] Potter, Lawrence G, Sick, Gary G, *Op cit*, p. 191.
[284] Potter, Lawrence G, Sick, Gary G, *Op cit*, p. 192.
[285] Potter, Lawrence G, Sick, Gary G, *Op cit*, p. 200.

Tim Niblock identified that even though the Saudi educational system expanded and became more inclusive, the syllabus did not prepare students for work.[286] In fact the main area of expansion was towards religious 'Koranic' universities. The situation is further complicated by gender but again space can only provide for a general overview so the focus will remain on young Saudi males. A religious education in itself is not a threat but with so many young and impressionable Saudi males graduating into unemployment it is no wonder that so many young men begin to question their role in society – a society that appeases the situation with generous welfare payments. The culture has become one where only certain jobs are worth doing.

Almost one third of the population is made up of ex-pat labour, who do work which has become 'untouchable' to a Saudi national. Furthermore ever since 9/11 world events have elevated the United States to a position where Washington's foreign policy is seen as aggressive and damaging to Islam. University is probably the only time when young Saudi's from all over the Kingdom are housed together and as such share ideas and influence one another. As they are not the first generation to struggle with finding a career it could be that a religious education is more in tune with the times, as opposed to studying for a degree in a subject that is not supported by an accessible career.

Fundamentalism on the other hand offers unity and self-esteem to young men, and is hardly likely to be criticized by the state as Saudi Arabia is the world's most prolific sponsor of the spread of Islam. Young Saudi fundamentalists will after all further strengthen the Sunni sect. It is often pointed out by Arabs that the West does not fully understand tribes and sects and this probably goes some way to explain why Sunni and Shia politics have become a western foreign policy concern post 9/11. More importantly, the battle for hegemony between Sunni and Shia sects in the Middle East is currently being fought by young men, of which there will need to be a steady supply to further the cause. Riyadh will condone the actions of Saudi nationals fighting opposing regimes in foreign countries but is powerless to prevent determined young men joining the fight. If there is a case for young Saudi fundamentalists becoming a

[286] Niblock, Tim, *Op cit,* 2006, p. 102-103.

security threat to the Saudi regime then it lies in the number of organized experienced fighters who form the opinion that the Royal family pose a threat to the continuation of the wider jihad.

Economic diversity

Speaking at Abu Dhabi in 2004 on future challenges to Gulf States former British Prime Minister John Major stated that multinational corporations cannot thrive 'without the assets of its host country – whether raw materials, intellectual property or straightforward labour – and, as the influence grows, so should their commitment to the country.'[287] The business world's past relationship with Saudi Arabia and vice versa has trod a troublesome path.

During the 70's oil boom western companies supplied Saudi with everything from ice cream to Portland cement. The Saudi economy ran on oil and there did not seem to be a pressing need to diversify the economy. Since the 70's however Saudi has expanded its own portfolio and allowed foreign investment into the Kingdom. In 2005 Saudi affirmed its commitment to the international business community with membership of the World Trade Organization (WTO). Despite the move towards globalization the way by which Saudi conducts business is a continuing cause of friction.

Connections with the Royal family are still the main route into business.[288] The figures are quite revealing. An in depth study by Tim Niblock reveals that 600 members of the Royal family have interests in 1044 business concerns in the Kingdom.[289] Of those concerns they are in partnership with fourteen merchant families who control the private sector. Unlike the oil sector which is based in the Eastern province, Saudi businesses are predominantly based in the west with Riyadh fast becoming the place of choice. Saudi companies themselves however do have their shortcomings. Niblock identifies a lack of long term planning and feasibility studies, reluctance to expand,

[287] ECSSR, *The Gulf Challenges of the Future,* ECSSR, Abu Dhabi, 2005, p. 59.
[288] Niblock, Tim, *Op cit,* 2007, p. 152.
[289] Niblock, Tim, *Op cit,* 2007, p. 133-135.

unaccountability and grace and favour recruitment processes.[290] Businesses in the private sector identified interference and competition from Saudi royals as major challenges, adding that royal status affords them privileges which leads to unfair competition.

How then has WTO membership affected the balance? For a start Saudi companies were hit by the two key WTO membership requirements, the removal of high tariffs and the reduction of subsidies. Previously enough profit could be made in the domestic market so there was no need to push into the global market. Also lack of competition left some merchants unable to counter against huge marketing campaigns launched by well-established multi-national corporations.

The downside for international business being that visa requirements are difficult to attain, the recruitment of women is problematic and Saudi nationals tend to expect higher than average salaries.[291] Furthermore Saudi families who go into business are reluctant to seek investors as they wish to remain in full control of their business. Families run the further risk of inviting conflict among children and other dependents regarding employment opportunities and inheritance.[292] Culture is therefore one area which struggles to accept common values and equalities present in the global business community.

On a wider scale cooperation with the international community has triggered projects that run alongside the Kingdom's own reform plans. The Saudi postal service, desalinization facilities and railways have been opened up to foreign investment.[293] Large projects do involve the added risk of corruption which is particularly rife in the construction and military procurement business. In 2007 The UK Serious Fraud Office decided not to prosecute BAE Systems regarding allegations that the company has bribed a Saudi Prince more than a billion pounds spread over a ten year period.[294] There are few countries where such an allegation would be taken seriously. But in doing so as far as business in Saudi Arabia is concerned it highlights the control the

[290] Niblock, Tim, *Op cit,* 2007, p. 142.
[291] Niblock, Tim, *Op cit,* 2007, p. 139.
[292] Niblock, Tim, *Op cit,* 2007, p. 161.
[293] Niblock, Tim, *Op cit,* 2007, p. 135.
[294] http://www.theguardian.com/world/2007/jun/07/bae1

Saudi Royal family personally hold over clients, and the vast sums of money clients are prepared to spend doing business in the Kingdom.

The Royal family and their trusted partners decide just how much economic diversity the Kingdom will merit, and as such it is up to them to invite clients and investors into the Kingdom. The population therefore has little choice but to build their lifestyles on whatever is available to them at the time, once it has filtered through the hierarchy.

Ongoing cooperation with the USA

The ongoing relationship between the US and Saudi Arabia has been the focus of decade long academic and political discussion. It would at first appear that the regimes Washington and Riyadh impose on their populations are diametrically opposed to one another. During the post-war years Riyadh has seen the US fight ideological wars against communism in South East Asia, station troops in Europe, influence dictators in South America and Africa, not to mention the US counter insurgent role in Afghanistan and intelligence campaign against Iran.

Topping the list is the US led regime change in Iraq, which left Saudi in no doubt that if need be the Kingdom could be next. Along the undercurrent flows a more pragmatic reason for the relationship to continue, despite the ups and downs that accompany any friendship, that of oil, and more importantly as Michael Klare forcefully argues, oil reserves.[295] Saudi's unique status as the worlds 'swing producer' in that the Kingdom retains spare production capacity with which Riyadh can 'control' the oil market during disruptions elsewhere in the world. As such oil is repackaged as security and the relationship is touted as one of security, in the bilateral sense of the word.

There have been times when the relationship has been strained, notably during the intifadas, the immediate post-9/11 fallout and the Arab-Israeli wars. The most serious breach of trust occurred in 1973 when in response to the US backing Israel during the Yom Kippur war, Saudi placed an oil embargo on the United States. Recently released documents state that the Nixon Administration was prepared to occupy the Saudi oil

[295] Klare, Michael, *Blood and Oil,* Penguin, London, 2004, p. 4-5.

fields if the embargo were to continue and weaken the US economy.[296] Instead the embargo was lifted and the relationship repaired.

When exploring Saudi instability there is room for discussion based around a 'worst case scenario' situation. Saudi Arabia has a modern well-funded up to date military. But the same situation did not stop the Shah's Iran from being toppled by Islamic fundamentalists in 1979. If the Saudi Royal Family found itself facing the distinct possibility of regime change, or indeed if the US wished to support and preserve the existing regime through strife, then oil security will hold the key.

Recent regime change in the Gulf

The Arab Spring was not the only 'revolution'. Qatar has overturned its conservative roots and quickly become a contradiction in terms, in that Doha is now the capital of a cosmopolitan Wahhabi state that on the one hand sells beer and pork but on the other criminalises homosexuality. The Emirate has survived a meteoric rise to compete with well-established nation states for offering foreign investment opportunities, hosting prestigious sporting events and establishing the well-respected but controversial Al-Jazeera media group; not to mention offering Washington a vast military base after US troops left Saudi Arabia at Riyadh's request.

Qatar's 'regime change' is a far cry from that experienced by Tunisia, Libya, Yemen, Egypt and potentially Syria during the ongoing Arab Spring. Qatar began to reform after the current head of state deposed his father in a bloodless coup without the apparent assistance of a foreign power.[297] After the coup Qataris were spared purges and sectarian violence. The point being that in Qatar's case there were no obstacles. It was the head of the regime that changed and his subjects followed – apparently whether they liked it or not.

A key reason why the Arab Spring has provoked little tangible interest in Saudi Arabia is that the House of Saud distributes wealth by way of providing welfare payments to its subjects that heavily subsidise the population's lifestyle. To rise up against the

[296] http://209.157.64.200/focus/f-news/1050070/posts
[297] http://www.independent.co.uk/news/world/emir-of-qatar-deposed-by-his-son-1588698.html

Monarchy would effectively sever this socio-economic bond. Indeed, The Carnegie Endowment for Peace report that faced with the prospect of unrest King Abdullah announced a further increase in welfare payments

> **Unlike the populist anti-regime demands in Tunisia, Egypt, Yemen, Libya, and Bahrain, activists in Saudi Arabia are not calling for King Abdullah to step down. To the contrary, the king remains a popular figure among most of the population, regardless of a person's opinion of the overall government. To defuse the situation, Riyadh is attacking the problem from multiple angles... and announced a $36 billion package on social welfare. The package includes more assistance for unemployment, housing, and finding new employment, and makes a 15 percent cost-of-living increase for state employees permanent. While people expected the king to announce some sort of public spending project upon his return, the scope and scale of the package was increased in light of developments in Tunisia and Egypt.**[298]

Could a new regime afford to continue such generous policies? But more importantly could a new regime mobilise a population that had grown accustomed to receiving salary increases regardless of productivity. Recipients of the current welfare system are unlikely to demonstrate against it. The last word on Saudi regime change goes to Patrick Buchanan. His rather blunt synopsis provides certitude

> **If the Saudi monarchy goes down, who and what do we think is going to replace it? [...] Can anyone believe that, should the 7000 princes go to the wall, 7000 liberal democrats will replace them? After Afghanistan and Iraq, do we still not know that when a state is destroyed, it requires years to rebuild, and the men with guns fill the vacuum? In the Middle East, Saudi Arabia is a Big Casino. Lose that, and we have lost the game.**[299]

The industrious debate centring on Saudi regime change looks highly likely to produce nothing but sore throats.

Conclusion

Events sometimes appear to resemble previous experiences and in the case of the Arab Spring and the Berlin Wall there may be certain similarities, but overall the two

[298] http://carnegieendowment.org/2011/03/10/revolution-not-headed-for-saudi-arabia/2q0?reloadFlag=1
[299] Aarts, Paul, Nonneman, Gerd, *Saudi Arabia in the Balance,* Hurst, London, 2006, p. 428.

events were not pattern forming but opaque. Further proof lies in the different socioeconomic reforms enacted in Eastern Europe after 1989 compared to those still being argued over in Arab Spring countries. The question surrounding how Saudi Arabia would behave if challenged by the Arab Spring was a concern. However, the threat has yet to have any major impact, a key reason being the relationship between the Saudi Royal family and the ongoing socio-economic welfare of Saudi citizens are so deeply entwined.

Currently Riyadh has little choice but to appease the Saudi population young and old with state handouts. Even if a proactive educational policy was introduced it would take years before the first graduates matriculated. As to where they would be employed would require the restructuring of the current Saudi business and commerce model. A silent but pertinent point regarding young educated professionals is that they may wish to have more input in not only their own, but their children's future, and push for a system that gives them a choice by way of a vote. This possibility alone may present a latent obstacle to traditional reform.

The offer and support for a religious education is again unlikely to change. For as long as the Sunni and Shia sects are divided it is probable that the Saudi government will not dissuade young Saudi men from pursuing a fundamentalist Sunni education. This is regardless of whether the teachings prompts some young men to choose violence, the majority of it abroad, as a way to promote and protect the Sunni religion. In as much as political instability, business diversity and young people are a constant worry to Riyadh, they are monitored by Washington too.

The reality for all Saudi's whether they like it or not is that the United States is not just the only country in the world with enough available resources to protect Saudi from aggressors, but also successive US Presidents have come to the aid of Saudi and other Gulf states for which they have paid the ultimate price of losing subsequent Presidential elections. Saudi oil will remain the 'o' in US – Saudi co-operation.

Double Hull Tankers

There is currently no more cost effective alternative to transporting oil than in tankers. Tanker design has evolved alongside a dynamic combination of market forces, geopolitical issues and build technology. Demand for oil applied pressure on operators to construct bigger and faster tankers. Geopolitical issues discussed in chapter 2 such as the closure of the Suez Canal in 1956 and again in 1973 forced tanker around the Cape of Good Hope on journeys from the Gulf to Europe and the United States. New tankers built for this route were named 'Cape sized'[300] vessels and were constructed to carry more oil as the longer distance meant fewer journeys. The tanker industry adapted well to these challenges but there were a number of unforeseen problems that arose in their development, when tanker design failed to take into account how new technology can have a detrimental effect when vessels are put into service.

Typical design and construction considerations

Designers learn from past experience and each new ship tends to be a development of a previous successful design. This is because of the extremely complex interaction of the many variables that affect the stresses in the structure of a ship at sea for example:[301]

- structural design: plate thicknesses, local stress concentrations, stiffness and proper transmission of loads
- construction quality—for instance, alignment, local imperfections, the quality of steel and welding
- distribution of the cargo weight in the ship
- static and dynamic forces of the sea and waves resulting from heaving, pitching, rolling and possibly slamming
- vibration from machinery

[300] For a concise explanation of various tanker sizes see: http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/shipsize.html
[301] No author, *Comparison of Single and Double Hull Tankers,* Australian Maritime Safety Authority: https://www.amsa.gov.au/forms-and-publications/Publications/Comparison_of_single_and_double_hull_tankers.pdf

- random corrosion
- the complex internal distribution of stresses between primary, secondary and tertiary structures

Legislation -v- industry conflict of interests

The *Exxon Valdez* oil spill in Prince William Sound in 1989 acted as a catalyst for replacing single hull tankers with double hull tankers.[302] The subsequent 1990 US Oil Pollution Act called for a gradual phase in of double hulled tankers – effectively banning single hull tankers from entering US ports.[303] Further spills by single hulled tankers in European waters, such as the *Erica* which ran aground off the Brittany coast of France in 1999[304] and the *Prestige* which suffered a structural failure off the northern Spanish coast in 2002, pressured Brussels into passing EU law for the phase out of all single hulled tankers entering EU ports and to replace them with doubled hulled vessels before 2015.[305]

Double hull design

Prior to the late 1980's tankers were constructed in a 'single hull' design but recent legislation has pushed operators into building 'double hull' tankers in a bid to increase safety and environmental concerns A single-hulled tanker carries oil directly within the hull structure, while a double-hulled tanker has separate tanks within the hull structure (See diagram below).

[302] Devanney, Jack, *The Tankship Tromedy: The Impending Disasters in Tankers,* CTX Press, Tavernier, 2006, p. 45.
[303] Akaki, Tony, *The Transportation of Oil by Sea,* iUniverse, New York, 2005, p. 88.
[304] Devanney, Jack, *Op cit,* p. 62.
[305] Devanney, Jack, *Ibid,* p. 72.

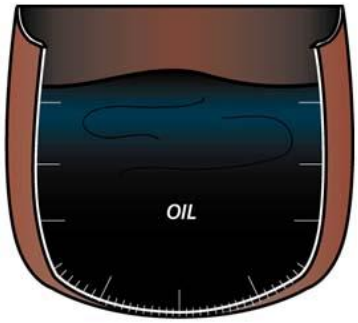

Fig 6.1 Single hull tanker diagram

In a double-hulled tanker, the cargo space that carries oil is surrounded by a ballast water space, which provides a buffer between the oil storage container and the outer hull. In order for a double-hulled vessel to spill oil from its containers, both the outer and inner hulls must be punctured or damaged.

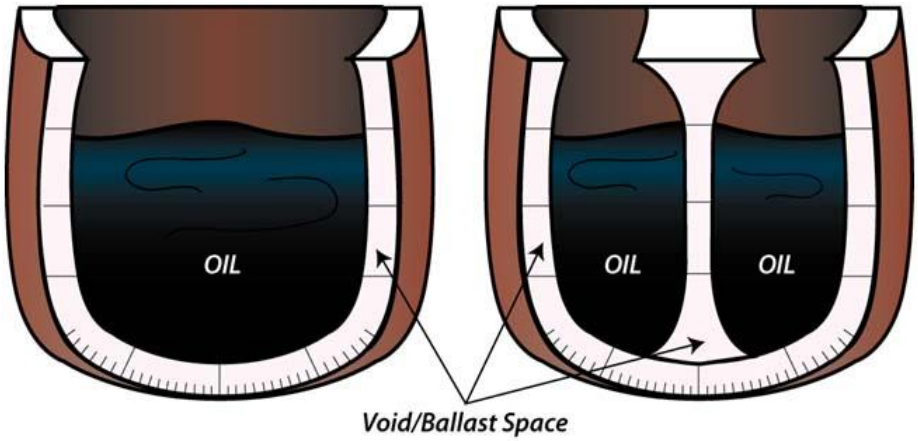

Fig 6.2 Single hull/Double hull tanker comparison diagram

A double-hull design may provide an additional safety benefit over a single-hull design during certain types of accidents, because with double hulls there are two layers of enclosures that must be punctured before oil can be released into the environment. Double hulls alone however cannot prevent gigantic oil spills. The Oil Company International Maritime Forum (OCIMF) and a spokesman from Lloyds both argue that double hulled tankers are not the panacea for Ocean security. They require a lot more maintaining and additional surface area to inspect.[306]

[306] Various, *Double Hull Tankers: High Level Panel of Experts Report,* 03/06/2005 http://www.seas-at-risk.org/1mages/EMSA%20DH%20high%20level%20experts%20report.pdf

The transition has not been without criticism. One industry commentator described members of the US congress as suddenly becoming 'naval architects'[307] in passing the 1990 Oil Pollution Act, given that little consultation had taken place with the tanker industry over such a far reaching policy change.[308] A further consideration has to be applied to tanker owners. From their conception tankers were owned by major oil companies who ran huge shipping departments and on whose reputation the tankers rested. As of the 1970s, tanker ownership switched to the private hands of small fleet owners or individuals. Individual owners often employed 'ships managers' to oversee the day to day running of operations, to the point where an 'owner' could be a pension or private equity fund. In such cases the 'owners' were purely interested in the financial benefits. This said, major oil companies did own enough tankers to tip the balance but the conflict of interests among owners during the transition from single to double hull tankers is described, rather bluntly, by former tanker owner Jack Devanney,

> **When the Exxon Valdez occurred, the environmental community was understandably ignorant on these matters. It saw an honest chance to make a difference for the environment and immediately called for double hulls.**
>
> **The industry response was interesting. The shipyards jumped at the idea. They could care less about the environment or killing tankermen. But they loved the new business.**
>
> **Tanker owners were split. Few cared much about the environment or killing tankermen. The calculus was based on how the new regulation would trim tanker supply and push rates up. If an owner felt he would come out ahead in the phase out process — an owner who had a young fleet — he supported it. If not — an owner who had lots of old ships — he opposed it.**
>
> **The divided owners had nil impact on the political process. The only momentary questioning of double hulls came from the oil companies' marine departments. At the time, the marine departments still had enough technical smarts and professionalism to realize there were safer alternatives, which would spill less oil. They mounted a campaign to put those alternatives before the US Congress, asking for less prescriptive legislation. But the oil company marketing types realized this was a loser. It would just piss off the customer, at a time when the public were already ranking oil companies below lawyers. When Conoco broke ranks with the "clapping seal" ad, showing all manner of animals**

[307] Devanney, Jack, *Op cit,* p. 46.
[308] Devanney, Jack, *Ibid,* p. 46.

> **happily applauding Conoco's new double hull VLCC, the marine departments knew they were dead. Oil company opposition to mandating double hulls evaporated. In fact, the oil companies jumped on the double hull bandwagon.[309]**

As far as the tanker industry was concerned legislation would have its day regardless. The transition did however have one major shortcoming. At this point most of the analysis regarding the benefits of double hull tankers was theoretical. Double hull tankers had not been involved in enough incidents to draw a comparison. As the majority of following case studies reveal, single hull tankers have been responsible for the world's major tanker disasters.

Double hull: an unknown quantity

Notwithstanding the traditional threats of weather, structural failure, military ordnance and disastrous practice and procedure which have previously claimed oil tankers, post 9/11 strategic discussion brought tankers into the fold as possible terrorist targets. As pressure mounts within the Gulf between Iran and its detractors tankers may yet again come under fire, as they did during the 'Tanker War', should conflict break out in the region. Following the Bayesian approach, in order to answer the question as to whether double hull tankers will fare any better or worse than single hull tankers when under attack, a number of case studies will be examined. The case studies have been chosen to reveal the nature, behaviour and resilience of modern day oil tankers, and will endeavour to, in part, dispel the myth among recent academic thought that they are a 'soft target' despite appearing so.[310] However, if double hulled oil tankers do appear to be more susceptible to bomb or missile damage would they be specifically targeted by terrorists or opposing military powers?

Case studies

The case studies draw together a series of diverse internal and external threats which have not only sunk or destroyed oil tankers but have also induced, or attempted to

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[309] Devanney, Jack, *Ibid,* p. 46.
[310] For two examples see; Suder, Gabrielle G. S, *Corporate Strategies under International Terrorism and Adversity,* Edward Elgar Publishing Limited, Cheltenham, 2006, p. 62; Raman, B, *Terrorism – Yesterday, Today, Tomorrow,* Lancer, Atlanta, 2013, p. 40.

induce, change within the tanker industry through legislation, prosecution, working practice or reviewing operational practices. The case studies focus on the technical nature and behaviour of oil tankers involved in incidents. The political and military motives will be discussed further in the thesis. The case studies will examine tanker explosions involving:

- Tank cleaning (internal explosion)
- Cargo leakage (internal explosion)
- Offloading (internal explosion)
- The 'Tanker War' (internal and external explosion)
- M.V. Limburg incident (external explosion)

The case studies will end with a technical analysis of the facts surrounding the causation of oil tanker disasters, as opposed to issues concerning the political and legal processes that accompany such disasters. The technical analysis will also include commentary from two members of the shipping industry; Mr. A Thonayan of the National Shipping Company of Saudi Arabia[311] and Professor Martin Stopford, Director of Research at Clarkson's Shipping Company Limited.[312]

Tank cleaning and the 'electrostatic charge' phenomenon

Tankers have for years been vulnerable to explosions caused by their own cargos. After several journeys transporting crude oil, a large waxy deposit forms on the inner surfaces of the vessels holding tanks. The crust is washed off using a well proven procedure involving a slowly rotating high speed water jet which physically impounds the surface. With the introduction of super tankers, larger more powerful jets were used. In 1969 three super tankers operated by Shell, the *SS Megara*, *Mactra* and *Kong Haakon VII* all exploded while undergoing tank cleaning exercises. Only the *Kong Haakon VII* survived.[313]

[311] Interviewed at SAOGE 18/11/2008. Full transcript of the interview in appendices.
[312] Interviewed at Clarkson's Shipping, London on 08/03/2010. Full transcript of the interview in appendices.
[313] Makin, B, *Static Electrification in Supertankers,* Dundee University, Dundee, May 1975, p. 110.

The cause was attributed to sparks from static electricity generated within the vapour, igniting the oil/water mix. After these incidents, tank cleaning was undertaken in an inert atmosphere whereby exhaust fumes from the engine are pumped into the cargo tanks during the cleaning operation. The overarching reason why static electricity was generated in the tanks lay in the tank size. All three vessels were new build constructions of a much larger size to existing tankers. There was therefore no previous experience regarding tank cleaning and the increased size of the tanks produced a sufficient environment to charge a static cloud.[314]

A further study by the US Coast Guard still blamed static electricity for the loss of five oil carrying barges between 1984 and 1988.[315] The oil and shipping industry has worked together to solve the static electricity problem to the point where to all intent and purposes it has been overcome. In some cases crude oil is used as a cleaning agent thereby further reducing the opportunity for an explosive mixture to occur.

Cargo leakage

In 1975 the *Berge Istra* sank without a trace followed by the *Berge Vanga* in 1979.[316] The ships were both 'oil and bulk' carriers able to carry oil or bulk ore. Their disappearance has been put down to cargo leakage as stated by Jack Devanney

> **The problem was that oil was leaking into the double bottom ballast tanks from cracks in the cargo tanks. In those days, the way a cargo surveyor checked for oil in the ballast tank was to use a mirror to send a shaft of sunlight down the ullage hatch. An experienced eye can tell if there is an oil, even a sheen lying on the top of the ballast water far below by the reflection. The crews in the *Istra* and *Vanga* were having so much difficulty keeping oil out of the double bottoms that they resorted to putting big buckets of water under the hatches. The cargo surveyor's mirror would see only the pail of clean water. This subterfuge cost them dearly. It was only a matter of time before the vapours in the double bottom were combined with a source of ignition.[317]**

[314] Makin, B, *Ibid,* p. 112.
[315] http://www.enautica.pt/publico/Professores/Baptista/NT_I/Static_electric.pdf
[316] Devanney, Jack, *Op cit,* p. 89.
[317] Devanney, Jack, *Ibid,* p. 89.

Cargo leakage has been attributed to a number of losses including *The Surf City*, *ABT Summer, Castillo De Bellver,* and *Khark 5*.[318] Ironically in the case of *The Surf City* and *ABT Summer,* the explosion occurred when the Chief Mate was inside the ballast tank checking for leaks. The industry has imposed more rigorous and stringent inspections in areas where leaked oil can 'pool' in the hull of vessels. The incidents involving the *Vanga* and *Istra* put an end to operations involving dual oil and ore carrying vessels.

Major unloading incidents

Probably the worst terminal incident occurred at Whiddy Island, Eire in 1979. The French flagged *Betelgeuse* exploded while offloading at the Gulf Oil terminal killing all forty two crewmen and seven people on the shore.[319] A high level of corrosion in the cargo tanks compounded the incident causing the tank walls to successively blow out as the explosion gathered momentum.

The salvage operation took nearly two years to complete and the terminal was closed permanently afterwards. The Irish government appointed a tribunal to investigate the incident, presided over by Justice Declan Costello. This tribunal took a year to hear evidence and prepare a 480 page report.[320] The report indicated three main factors that had contributed to the incident.

It was determined that a faulty unloading operation had unbalanced the vessel, causing it to break its back and thereby rupturing several empty ballast tanks. Vapour from the ruptured tanks had escaped into the vessel and exploded in a fireball.[321] However, the Costello tribunal's findings were never accepted by Total.

Subsequent information regarding the tragedy revealed that the Classification Society, which passed the ship as fit for being insured, were aware that the vessel's owners Total Oil were about to sell the ship. Total had neglected to maintain the vessel, but

[318] Devanney, Jack, *Ibid,* p. 89 - 90.
[319] Devanney, Jack, *Ibid,* p. 31.
[320] http://www.iaemo.ie/majorAccidentReports/24737653-Disaster-at-Whiddy-Island-Bantry-Co-Cork.pdf
[321] http://www.iaemo.ie/majorAccidentReports/24737653-Disaster-at-Whiddy-Island-Bantry-Co-Cork.pdf

as Total were a big customer of the Classification Society certain key aspects, such as the corrosion in the cargo tanks, had been overlooked. Directly after the disaster Total were praised for being a large employer which had invested heavily in the area and ultimately avoided prosecution for manslaughter.[322]

A similar accident occurred to the *M.V.Haven* in 1991. Ironically the vessel was the sister ship to the ill-fated *Amoco Cadiz* and also a veteran of the tanker war. It exploded during an internal transfer of oil and burnt for three days at the Multedo floating platform in Genoa harbour. The wreck was then towed inland to shallow water where it was sunk at a place where the vessel posed no further danger to shipping. Sinking the tanker put the fire out and limited any pollution to the shore area. The incident prompted Italian prosecutors to charge the vessels owners with manslaughter.[323]

At the centre of the case was the allegation that the vessels owners had kept the ship in such disrepair that it blew up. According to news items it is also alleged that the tanker was scrapped after being hit by an Exocet missile during the Iran–Iraq War and should not have been put back into operation. Prosecutors had asked for seven-year sentences for manslaughter. In 2002 the owners were eventually acquitted of any wrongdoing.[324]

The 'Tanker War'

The effect of military ordnance on oil tankers is surprisingly benign. Missiles, rockets and sea mines are designed to inflict damage on military naval vessels, the design and construction of which as vastly different to that of a tanker. Tankers have thick hull plates ranging from 25mm to 31mm compared to only 8mm for a warship.[325] This disparity in hull thickness alone has proved to be too much of a barrier for ordnance to be effective when tankers have been targeted in past conflicts. The reason why tankers are so resilient is also explained in their Spartan composition. The hull of an oil tanker is constructed from steel plate held together by a lattice work of structural

[322] Devanney, Jack, *Op cit,* p. 31.
[323] Devanney, Jack, *Ibid,* p. 37.
[324] The *Haven* was leased to the Troodos Shipping (a company run by Lucas Haji-Ioannou and his son Sir Stelios Haji-Ioannou former owner of Easyjet).
[325]Hooton, B.R, Navias, Martin S, *Tanker Wars,* Tauris, 1996, p. 86.

upright and cross members. Aside from this assembly the hull is hollow apart from the individual tank walls. Only the superstructure, living accommodation and engine room at the stern contain enough material for which rockets and missiles are effective, as they were designed to incapacitate warships with dense interiors.[326] An oil tankers resilience to sinking should not be understated.

Conditions in the Gulf

The anti-shipping campaigns of Iran and Iraq known as the 'tanker wars' were to be the most sustained assaults on merchant shipping since the Second World War. Between 1982 and 1986 two hundred and thirty nine tankers were targeted in the Gulf, killing one hundred and sixty crewmen.[327] The vast majority of tankers fell prey to air to surface missiles fired by Iraqi or Iranian Air Force jets. Pilots had the additional problems of detecting targets due to: the volume of traffic in the Gulf, the thick heat haze that hung over the surface of the water during daylight hours and poor command and control facilities.[328] In a few cases tankers hit mines laid in the shipping lanes but whether the damage was caused by rockets or mines it became apparent that tankers were very difficult to sink.[329] The underlying reason for this was that in almost all cases damage occurred on or above the ships' waterline. Tankers hit during the tanker war can be split into two distinct categories: tankers hit while in ballast (empty of cargo) and tankers loaded with oil.

Tankers 'in ballast'

The most destructive 'in ballast' incidences occurred when missiles ignited the air/oil vapour mixture inside the product tanks. If the tank had not been inerted by the vessels exhaust gasses then the resulting explosion blew the tank hull wall out. A further danger lay in shrapnel igniting the vessel's bunker fuel.[330] The Iraqi and Iranian Air Forces held a strategic interest in only attacking loaded tankers, therefore reducing their adversaries export capability. Empty tankers in ballast were usually hit when

[326] Hooton, B.R, Navias, Martin S, *Ibid*, p. 85.
[327] Hooton, B.R, Navias, Martin S, *Ibid*, p. 205-214.
[328] Hooton, B.R, Navias, Martin S, *Ibid*, p. 85.
[329] Examination of casualties reveals that Bulk Carriers and Container Ships were more likely to sink due to their design; Hooton, B.R, Navias, Martin S, *Ibid*, p. 133-138.
[330] Hooton, B.R, Navias, Martin S, *Ibid*, p. 86.

opposing sides encountered each other in aerial dogfights.[331] In such a situation pilots often picked a random target so they could jettison their payload in order to gain speed and manoeuvrability in the air and outwit their adversary. There was however a distinct advantage to firing the missile at short range.

An Excocet is packed with a 165kg fragmentation warhead which was compounded by any unused propellant (150kg when fully fuelled).[332] Missiles that struck the hull punched their way through the steel plate and exploded inside empty tanks or tanks containing ballast water. The explosion either buckled the internal tank walls or tore through the upper, deck damaging pumps and loading hatches. In twenty three reported cases Excocet missiles punched through the hull wall but the delayed action/proximity fuse failed to detonate.[333] These missiles were defused in situ by US military personnel as the tanker steamed north into the Gulf to load oil.

Loaded tankers

Crude oil is very difficult to ignite and tended to absorb the explosion. Where a missile did penetrate into the tank and explode, the shock wave would rupture the tank and pour oil into the hull's internal structure where the fumes would mix with air often provoking a secondary explosion. However when oil is ignited inside a tanker, a crust forms on top of the crude which can eventually contribute to a so called 'boil over' effect. The fire causes the heavy crust to sink down into the cooler oil below and further fuels the fire. If the crust sinks even deeper it reaches a water layer. The water is instantly vaporized and a boil over occurs, causing flames and boiling oil to spurt from the vessels open vents.[334]

Ironically, salvage engineers found that tankers tend not to explode once they have started burning. Salvers further discovered that tankers, unlike cruise liners and passenger ferries, do not capsize from the weight of water flooding onto the decks during fire-fighting activities, therefore opening the use of copious amounts of

[331] Hooton, B.R, Navias, Martin S, *Ibid*, p. 82.
[332] Hooton, B.R, Navias, Martin S, *Ibid*, p. 86.
[333] Hooton, B.R, Navias, Martin S, *Ibid*, p. 86.
[334] Hooton, B.R, Navias, Martin S, *Ibid*, p. 86.

seawater to flood the deck of a burning vessel. Under certain conditions however tanker fires were be left to burn out naturally rather than endanger lives fighting the fire. In one case, the Cypriot, Very Large Crude Carrier (VLCC), *W. Enterprise* bunker fuel burned for five days causing the accommodation block to ultimately collapse into the hull. This amount of structural devastation did not prevent salvage engineers saving the cargo and the hull, which was later sold, re-fitted and re-launched. A marked example of the astonishing systematic ingenuity often attributed to the shipping industry.[335]

The M.V. Limburg incident

The last case study concerns the only example of a double hull tanker. The French flagged VLCC *Limburg* suffered intense fire damage but remained afloat after it was hit by al Qaeda terrorists in October 2002. The tanker was waiting off the coast of Yemen for a pilot to assist loading at the nearby Nexen Ash-shihr offshore export terminal when it was hit by a speedboat packed with explosives. Tanks one, two and four were already loaded with Arabian Heavy crude from Saudi Arabia. The blast made a hole in the number 4 starboard tank which started a ferocious fire. Had the impact been only a meter more to the right then the explosives would have instead holed an empty tank full of inert gas causing far less damage than was actually achieved.[336]
The fire was put out, and four days later the *Limburg* was towed to Dubai, United Arab Emirates. The damage to the tanker was around $45 million. The fact that the *Limburg* remained afloat greatly assisted its removal by salvage tugs. This point is often overlooked in literature concerning the probability that a burning tanker will automatically block a narrow waterway. Yemen, the country from where the threat originated, suffered due to insurance underwriters quickly increasing premiums by 300 percent on vessels entering Yemeni ports. The increase had an immediate detrimental effect on the Yemeni economy as it effectively paralysed the country's seaborne import and export trade, not to mention $13.1 million a month in port revenues.[337]

[335] Hooton, B.R, Navias, Martin S, *Ibid*, p. 86.
[336] Brown, Hugh, *Oil Pollution and Terrorism,* Holman, Fenwick and Willan, 2004, p. 2.
[337] www.thebreakingnews.com/files/articles/2006-mipt-terrorism-annual.pdf

Technical analysis of the facts

Analysis of the case studies determines that internal explosions as opposed to external explosions are the greater risk to oil tankers. The threat comes in the form of a suitable environment for an oxygen/oil mixture to form and ignite. Other contributing factors point to personnel and unloading malpractice, the condition of the vessel and in the case of the 'Tanker War' the effectiveness of military ordnance.

The al-Qaida attack on the *M.V Limburg* probably failed to have the desired effect, prompting a change in strategy as reported after documents were sized during the May 2nd 2011 US Navy SEAL raid in Pakistan which killed al-Qaida's leader Osama Bin Laden

> **[The] FBI and the Homeland Security Department said that al-Qaida sought information on the size and construction of oil tankers, and determined that blowing them up from the inside would be easiest due to the strength of their hulls. Al-Qaida recommended test runs of the plot.**[338]

The hull forms the key to the formation of an explosive mixture, either by leakage or a crack in the cargo tanks while unloading oil. When asked whether a double hull tanker could potentially react in the same was as a single hull tanker in that it could provide a suitable space for oil to pool and be inspected against such an eventuality A. Thonayan of the NSCSA stated

> **[A]l of the steelworks in these new designs it's a bit complicated because it's a very narrow area and a very congested area, especially when it's around the bends, around the keel and around the bottom of the ship. That area is going to be very difficult for surveying. That's the way I see it.**[339]

Professor Martin Stopford felt that the sophisticated design of double hull tankers would only fair worse than a single hull should a major incident occur

> **I mean double hold tankers have done well in low impact groundings basically. That's where they're at the best, because you breach the outer skin, you don't breach the inner skin...if you breach both skins, you're worse off with a double hold, because they sit**

[338] http://www.nytimes.com/2011/05/21/world/middleeast/21qaeda.html?_r=0
[339] Interview with A. Thonayan 18/11/2008. See appendices p. 310.

> **higher in the water...If in fact you actually make a hole in both of your tanks, then you're going to be worse off with a double hold tanker because you spill more oil.**[340]

When asked about the prospect of double hull oil tankers being targeted in any future conflict Professor Stopford stated

> **[I]n military terms – I mean the Gulf proved not to be a major problem during the war in the 80's, I don't believe the generally available of weapons have changed all the much, so one assumes that modern tankers could cope with a degree of hostilities, as they did then.**[341]

As the risk of an internal explosion and the threat of an explosive mixture forming in the hull are transferable between single and double hull tankers, it can only be assumed that new build double hull tankers will unfortunately succumb to similar accidents involving single hull tankers. The severity of any such future accident is likely not to rest solely to the double hull design but will involve other natural, material and human factors as well.

Conclusion

Legislation will dictate the introduction of double hull oil tankers however the design will not lessen the risk or threat of accidents. The conditions required to produce optimum damage to double hulled tankers are too difficult to reproduce on an individual basis by terrorists or an opposing military power. But should such an event occur the impact on the shipping industry would have no measurable effect on supply. Random acts of terrorism may still pose a minor threat but can be insured against. Wharton Business School argue that a market for terrorism insurance will only be created if buyers and sellers carry out a more systematic analysis of the relationship between the price of protection and the implied risk of terrorism.[342] Implied risk aimed at tankers could well be any unsubstantial, improbable and perceived threat that would, at best, only replicate a previous accident or casualty of war involving an oil or gas tanker. As bad as any of the incidents in the case studies involving internal

[340] Interview with Martin Stopford 08/03/2010. See appendices p. 334.
[341] Interview with Martin Stopford 08/03/2010. See appendices p. 321.
[342] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.386.8427&rep=rep1&type=pdf

explosions were, it would be very difficult for terrorists to recreate the exact conditions needed to repeat the incident. A. Thonayan added further clarity responding to my two questions[343]

Did the attack on the Limburg have very little effect on the shipping industry?

Indeed, very little effect.

If double hull tankers prove to be more susceptible than single hull tankers, do you think that this would prompt terrorists to attack them more often?

No, because terrorists don't know whether it's double hull or single hull, they cannot tell.

Mr. Thonayan's rather 'over the shoulder' final rejoinder could well hold water.

[343] Interview with A. Thonayan 18/11/2008. See appendices p. 315.

Strait of Hormuz

The Strait of Hormuz is a principle area of international concern. The end of the Cold War significantly reduced the number of strategic target areas where interference by East and/or West would frustrate each other's policies. The security of the Strait has remained key during and after this process.

Previous academic investigation is universally conclusive that Iran does not possess the capability to close the Strait of Hormuz. Regardless of whether Iran could close the Strait or not there has been a lack of modelling concerning the resulting world position arising from an effective closure of the Strait, should Iran develop its existing capability. The syllogism may well be theoretical but it is certainly not an exercise in 'blue sky thinking'. If analysis is upheld by technical accuracies and Bayesian evidence concerning earlier disruptions, a robust model can be constructed.

In order to answer the above question it will be assumed that Iran can close the Strait by 1) a single blockade scenario 2) a series of closures involving Iran and its allies. The discussion will begin with the importance that Washington has afforded the Strait of Hormuz in terms of supply and developing foreign policy. An up to date political and economic geography of the Straits will then highlight the waterway's strategic position in the oil supply chain. Tehran's possible future nuclear threat will be discussed, reinforced by commentaries on the operating status of oil tankers, insurance companies, the media and traders, should a crisis occur. Discussion will then turn to the probable effect of a single and then extended closure of the Strait on the shipping industry and its residual effect including alternative export routes. Finally the stigma attached to such a disruption will be considered followed by a conclusion. In order to add further weight to the thesis the pragmatic opinions of Professor Martin Stopford, Director of Research at Clarksons Shipping Company will be incorporated into the assessment.[344]

[344] Interview with Martin Stopford 08/03/2010.

One way in – one way out

Roosevelt was also aware that the only practical and economic route for Saudi Arabia to export oil was by tanker through the Strait of Hormuz. In 1945 it would have been inconceivable to think that a military force other than the US could close the Strait of Hormuz. A major tenant contributing to the ongoing success of US-Saudi relations since the Great Bitter Lake meeting has been maintaining the free and unhindered flow of tanker traffic through the Straits of Hormuz.

To date, and regardless of being labelled a 'chokepoint',[354] the Straits of Hormuz have remained constantly open to maritime traffic. However, over these same years transiting the Straits has become somewhat taken for granted. The importance of the waterway to US-Saudi relations has therefore been gradually underestimated, often by other more immediate and pressing concerns surrounding Gulf security.

The US however does not solely depend upon oil imports from Saudi Arabia. In order to preserve the dollar as the world's reserve currency, America also depends on OPEC oil fulfilling market demand and physically reaching customers so that dollar transactions can be completed. If the Straits had been susceptible and succumbed to blockades or closures, the US-Saudi relationship would have most probably veered along a different course to the one held today.

The sustained opening of the Straits also gave tanker operators the confidence to build larger vessels which are so big that they cannot berth at small loading terminals in many other exporting countries. In short the physical roll the Straits of Hormuz have played by remaining open to traffic come what may has silently but deeply not only underpinned US-Saudi relations but has also proved to be a stealth dependability during subsequent presidential terms.

Washington initially secured the supply source but as the US economy steadily grew, US industry and American citizens have dictated demand not only in terms of oil consumption but also in the sustained strength of the dollar resulting from OPEC

[354] Rodrigue, Jean-Paul, *Straits, Passages and Chokepoints: A Maritime Geostrategy of Petrolium Distribution,* Vol. 48, No. 135, p. 359.

revenues. As such, successive US Republican and Democratic Party Presidents have been forced to uphold the security of supply for fiscal, commercial, economic and lifestyle reasons, the success of which is assumed to be a key tenant for keeping them in power.

As US industrial growth and lifestyle expectations have increased, so has the need for ongoing US security and intervention in the Gulf, although despite the strategic nature of the Strait of Hormuz there has never been a permanent US military presence stationed in or along the shores of the waterway. Despite the continuity the Straits have afforded the supply chain they have in the past been threatened with closure. However, so far the only threat of closing the Straits has come from hollow soundings made by Iran during the Iran-Iraq war which have been subsequently repeated on several other occasions.

Geography of the Strait of Hormuz

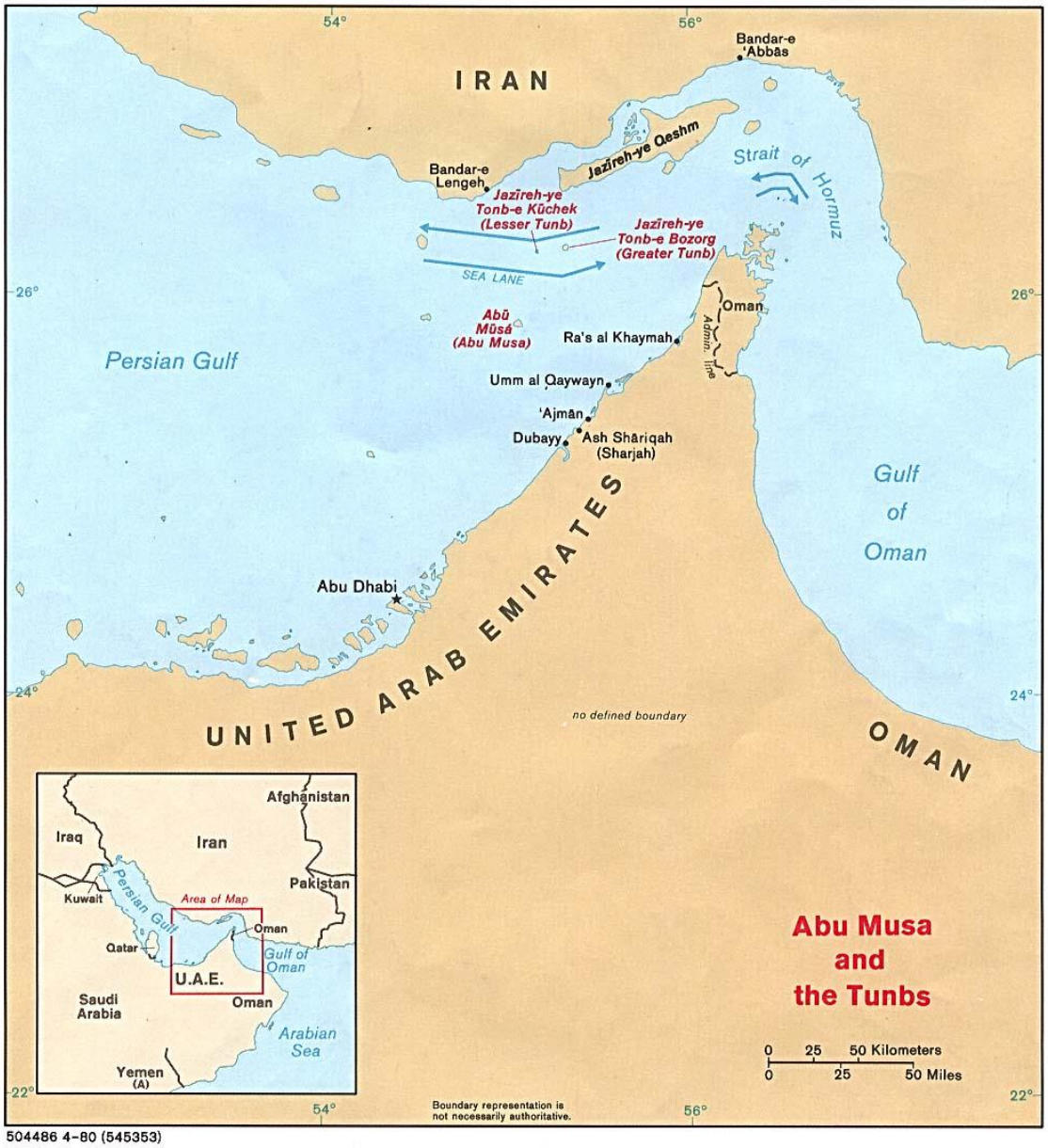

Fig 6.3 Strait of Hormuz map

The Strait is roughly forty five kilometres miles wide at its narrowest point. Depending on demand approximately two thirds 17m b/d of total world oil trade transit the Strait of Hormuz, representing 40% of world daily demand.[355] In tanker terms this equates to a combination of between twelve to fifteen loaded Very Large Crude Carriers (VLCC) and Ultra Large Crude Carriers (ULCC) exporting oil. In order to fulfil later lifting's just as many tankers steam 'in ballast' (empty) into the Gulf to replenish those

[355] Cordesman, Anthony, *Iran, Oil and the Strait of Hormuz,* CSIS, Washington DC, 26/03/2007, p. 2.

that have departed. A few smaller Aframax and Panamax tankers may also steam out through the Strait with reduced consignments destined for ports that cannot accommodate VLCC or ULCC vessels. The inbound and outbound shipping lanes marked on the map above are three kilometres wide each with a three kilometre buffer zone between them. As such the shipping lanes and the distance between the lanes is the same as those applied to shipping lanes in the open sea.

The northern shore is occupied by Iran in what is, apart from the port of Bandar Abbas, a remote region of the country with a poor logistical infrastructure. The southern shore is shared by Oman and the United Arab Emirates who collectively cannot defend the waterway. The Strait generally does not fall prey to storms or unpredictable weather conditions and to the main remain calm, although there is often a blanket of heat haze covering the surface.

At the western mouth of the Straits sit Greater Tumb, Lesser Tumb and Abu Musa Island.[356] Sovereignty of the islands has been disputed between the United Arab Emirates and Iran, with Iran now occupying the islands.[357] Intelligence suggests that Iran has stationed and tested surface to ship missiles on the islands[358], the questionable effectiveness of which are discussed in the thesis.[359] Martin Stopford sums up the possible risk as

> **The transit in military terms – I mean the Gulf proved not to be a major problem during the war in the 80's, so I don't believe the generally available weapons have changed all the much, so one assumes that modern tankers could cope with a degree of hostilities, as they did then.[360]**

Previous evidence discussed in this thesis, and Stopford's rather dismissive wave at the effects of available conventional weapons on oil tankers, detracts somewhat from the vast industry academics have created in this area.[361] Regardless of the effectiveness of available weapons the current assumption is that Iran does not

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[356] Potter, Lawrence G, and Sick, Gary G, *Security in the Persian Gulf*, Palgrave, New York, 2002, p. 135.
[357] Potter, Lawrence G, and Sick, Gary G, *Ibid, p. 136.*
[358] http://www1.american.edu/ted/abumusa.htm
[359] Barnes, Joe, Jaffe, Amy Myers, *The Persian Gulf and the Geopolitics of Oil,* Survival, IISS, London, Vol. 48, No. 1, Spring 2006, p. 153-154.
[360] Interview with Martin Stopford 08/03/2010. See appendices p. 321.
[361] http://www.iags.org/n0111041.htm

possess the ability to close the Strait of Hormuz utilizing an arsenal of conventional weapons for any sustained period.[362] A closure would mean exposing a large proportion of its navy to retaliation, and stationing troops on the remote southern shores of the Strait and on the Tumbs and Abu Musa islands would again expose these troops to retaliatory forces. Such a venture would undoubtedly leave Tehran with inventory losses that would be impossible to replace due to sanctions, not to mention a list of needless deaths to explain.

Could Iran close the Strait of Hormuz?

Could Iran physically close the Strait of Hormuz? Academically yes if Tehran received no retaliation. However no retaliation would be highly unlikely in the case of Hormuz, but the 'no retaliation' situation is not unknown. Egypt after all received no retaliation when Nasser closed the Suez Canal in 1967 for eight years. A blockade of the Strait would only be effective if all shipping were to recognise the blockade and cease steaming in and out of the Gulf. Iran conducts regular naval exercises in the Strait. In May 2010 Tehran conducted the Velayat 89 consisting of

> **[A]ir, land, and sea forces exercise in the Gulf – including the Strait of Hormuz – and the Indian Ocean. According to IHS Jane's, "[…] the eight days of exercises included mine clearance and detection; torpedo and missile simulation; mobile support and command-and-control exercises; simulation of radar and missile units; and special operations deployment into the naval area of operations.[363]**

America responded by stationing the fifth fleet nearby and was sufficiently worried by Tehran's actions to counter any threat posed by the combined Iranian armed forces, should the exercise manifest itself into a reality. Washington would appear to think Iran could close the Strait although only for a limited short period given the firepower in place to prevent a blockade. However even a short term blockade could potentially have far reaching consequences. Returning to Bayes theory, a blockade of any length would alter the *status quo,* as the Strait of Hormuz has never been completely closed to all vessels. One possible reason that prevented international action from re-opening

[362] Cordesman, Anthony, *Iran, Oil and the Strait of Hormuz,* CSIS, Washington D. C, 26/03/2007,, p. 6.
[363] Navy [Iran]," Jane's Sentinel Security Assessment – The Gulf States, Jane's, last posted September 30, 2013.

Suez in 1967 was the likelihood that the canal would be closed shortly afterwards again by the Egyptians. The 'stigma' attached to a change in the *status quo* that a closure of the Strait could do is discussed later in this chapter. The closure itself would depend upon any retaliation defeating the Iranian armed forces. The effectiveness of a blockade rests on Iran's resilience, although from Tehran's perspective the damage is done when the blockade is officially recognised as successful, as from that point forth the closure cannot be undone leaving the only doubt hanging over the Strait of Hormuz.

Is a closure of the Strait of Hormuz within Tehran's interest?

Logic would determine a closure of the Strait of Hormuz as being financially disastrous for Iran, but cannot be completely ruled out. Indeed if Tehran demonstrated enough interest in doing so, and insurance underwriters felt that conflict would occur, then the rise in insurance premiums for vessels attempting to transit the Strait may be enough to cause an 'on paper' blockade based on risk as opposed to a physical blockade.

The loss of Iran's export oil and the revenue earned from it serves as the predominant factor discouraging Tehran from making a serious bid to close the Strait. However, the loss of revenue by neighbouring exporting states would be far higher. That said, Tehran are unlikely to close the Strait on the grounds of spiting their neighbours. If anything the reason would be in response to sanctions. From Tehran's point of view the sanctions placed on Iranian oil exports could be said to have the same effect as a blockade, leaving Iran with little to lose financially if the Strait is open or closed. During 'Velayat 90' the follow up exercise to Velayat 89 mentioned above, Tehran issued the following statement '[i]f sanctions are adopted against Iranian oil, not a drop of oil will pass through the Strait of Hormuz.'[364] The statement did not prevent sanctions being imposed in a measure which led the US Treasury to announce

[364] Al Arabiya with agencies, "Iran: No Oil Will Be Allowed to Pass Through Strait if West Applies Sanctions," Al Arabiya News, December 27, 2011. http://www.alarabiya.net/articles/2011/12/27/184839.html

Sanctions have effectively terminated international access for most Iranian banks...Today, the Iranian government is relegated to the backwaters of the international financial system, and they know it.[365]

It would appear that the international community, led by the US, are confident enough that Tehran will not execute the threat to close the Strait on the grounds of sanctions alone. Clearly Tehran's loss of oil revenue is insufficient a reason for Iran to attempt a possible closure. The sufficient reason will therefore lie within situations unknown in the future, but to say never may well turn out to be hubris.

In 1984 the Canadian made film 'Countdown to Looking Glass'[366] chronicled the events after (the now Soviet backed) Oman placed a toll on oil tankers sailing through the Strait of Hormuz. Although the film was fiction the following course of events were enacted as if a war game. The thesis has previously argued that Iran does not currently have the available force to close the strait or a good enough reason to do so. However, to say Iran or any other nation will never close the strait is a risk in itself. Just because there has not been a closure of the strait does not rule a closure out in the future.

Hooton and Navias State that in September 1980, during the Iran-Iraq war, the British and American governments were consulting on actions should the straits close.[367] In October 1983 the Iranians threatened to close the straits again.[368] US President Reagan replied that a closure of the strait would not be tolerated and America would not rule out military action in a war they were not directly involved in yet.[369] Saudi Oil Minister Yamani stated that even if the Iranians closed the strait it would take one or two weeks to open it again.[370] Similar threats have resonated through the years. In June 2006 for example Iran reminded the US that any 'mistake'[371] aimed at Tehran's nuclear project would jeopardise the flow of oil from the region[372]. Saudi's Prince Turki

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[365] http://in.reuters.com/article/2012/09/12/usa-sanctions-idINL1E8KCKRX20120912
[366] Countdown to Looking Glass, http://www.imdb.com/title/tt0087090/
[367] Hooton, E.R, Navias, Martin S, *Op cit,* p. 41.
[368] Hooton, E.R, Navias, Martin S, *Ibid,* p. 57.
[369] Hooton, E.R, Navias, Martin S, *Ibid,* p. 63.
[370] Hooton, E.R, Navias, Martin S, *Ibid,* p. 63.
[371] Khalaf, Roula, *Iran threatens oil disruption in event of US 'mistake',* https://www.ft.com/content/c0ec2dee-f3f2-11da-9dab-0000779e2340
[372] Khalaf, Roula, *Ibid*

warned the US that such a move could increase the price of oil to over $200 a barrel.[373] Later in January 2008 an incident in the strait involving the Iranian and US Navies prompted Walter Posch at the EU Institute for Security Studies to affirm that this incident, as with previous incidents, 'illustrates that the risk of escalation following misunderstandings or accidents [in the Strait of Hormuz] remain high'.[374] These examples draw attention to the high level interest and determined action should a closure of the straits take place. The response has not changed for over 30 years. The potential for any closure of the Straits of Hormuz still tops the Gulf Security agenda.

The Iranian threat

Since 9/11 the threat from Tehran has marginally increased. The threat of terrorism has entered the theatre, as has the range of possibilities open to Tehran should Iran succeed in developing a nuclear weapon. Terrorism has so far only produced a single incident in the Strait which will be discussed later in the thesis. Joe Barnes and Amy Myers Jaffe state on Tehran's position regarding Iran's current and future threat to the Strait of Hormuz

> **Iran would more likely bar passage of ships from specific countries or merely threaten to do so. This would carry much more weight with exporters and shippers were Tehran to possess nuclear weapons, by raising the stakes should Washington or any of its allies choose to challenge any Iranian threats...In short, a nuclear Iran could pose a substantial threat to the free flow of oil from the Persian Gulf by raising the stakes of any serious conflict with Iran on any matter, even unrelated to oil.** [375]

The statement is certainly realistic but given the amount of tankers registered to 'flag of convenience' countries, calls into question which specific countries Iran would possibly bar passage to?

[373] Bolger, Joe, *A war against Iran 'could drive oil price above $200 a barrel',* The Times, London, 22/06/2006, p. 48.
[374] Posch, Walter, *Provoking an Agreement? The Hormuz Incident Revisited,* EUISS, Paris, 2008, p. 7.
[375] Barnes, Joe, Jaffe, Amy Myers, *Op cit,* p. 154.

Flag of convenience

The shipping industry and with it the strategic importance of oil in transit is generally in the hands of private owners. These owners can register their vessels under a different flag to the one they operate from and trade without much interference from government regulation. Flag of convenience states such as Monrovia, war torn Liberia and the remote Marshall Islands may offer an alternative to the high operating costs and enhanced regulations of the owner's domicile country, but provide little by way of protection during politically motivated conflict.[376] Such is the importance of the oil market to the US that it would be left for Washington to decide whether they would adopt and provide protection for tankers flying a flag of convenience. To its credit though, the shipping industry has maintained its independence and has adapted well to work alongside the commercially driven chattel like trading culture of the oil market. Morris Adelman describes the relationship as thus

> **Whether a supplier loves or hates a customer (or vice versa) does not matter because, in the world oil market, a seller cannot isolate any customer and a buyer cannot isolate any supplier.[377]**

Given the complexities of defining exactly which countries to bar, and even if Tehran did execute a ban, it is unlikely that the ban would impact on the chosen target country due to the fluidity of the relationship fostered by the combined oil and shipping industries,

Earlier discussion has revealed just how little of the Saudi Arabia oil supply chain is of Saudi origin. Furthermore the oil supply chain has been 'serviced' by non-Saudi personnel for some time, so much so that it has become the *status quo* for external foreign goods and services to maintain the oil supply, and the privately owned tanker shipping industry to export crude oil. For oil exporting states in the Gulf maintaining an unhindered export route has always been the key factor. Conversely, the materials, equipment and parts needed to service and maintain the oil supply are imported via the same route – through the Strait of Hormuz – making the Strait not only vital for the

[376] Devanney, Jack, *Op cit,* p. 23.
[377] Maugeri, Leonardo, *The Age of Oil,* Praeger, London, 2006, p. 267.

sale of oil but also the ongoing running of the physical oil supply chain infrastructure, and development of new projects.

Insurance concerns

Before a closure took place it is highly probable that there would be a build up to the event. In such a case insurance companies could take a view that the Straits of Hormuz posed an increasing risk to shipping and would therefore command a premium to vessels in the area. During the Iraq-Iran 'tanker war' insurance premiums were imposed by latitude. The geographic limits were determined by the amount of hostility provided by Iraqi and Iranian Air Force sorties in the Gulf.[378] However, oil tankers were not attacked in the Strait of Hormuz during the 'tanker war'. Iraqi fighter jets simply did not have the range to complete sorties and Bagdad was far more concerned with attacking vessels in the Kharg Island area in the northern Gulf.

Consideration must therefore be placed on the availability of tankers prepared to enter the Strait under such circumstances. The shipping industry during the 'tanker war' was in a far different position than it is today. The current tanker market is a lot 'tighter' than it was during the 1980's when owners could benefit from a large second hand market as described by Stopford

> **[T]he tanker war coincided with a period when the tanker industry was on its knees financially and therefore no one had any money, nobody really paid much attention to the industry, it was just a destitute business. A lot of the tanker owners during the war wouldn't insure their ships, the chances of sinking a ship with the weapons they had then was not that great. On the whole what tended to happen is that the ones that went up the Gulf were the old ones, and people like the Troodos Shipping Company would pick up these ships for three, four million dollars, trade them at the Gulf, take their chances and then they scrapped them when the market got back to normal.[379]**

Nevertheless, despite sending old tankers into the Gulf, Saudi Oil Minister Yamani commented that if Lloyds of London ceased to insure tankers in the Gulf it would be

[378] Hooton, E.R, Navias, Martin S, *Op cit,* p. 182.
[379] Interview with Martin Stopford 08/03/2010. See appendices p. 333.

'Equal to closing the Strait of Hormuz'.[380] Insurance premiums could rise to a point where the price would preclude any available tankers from entering the Strait even if they were prepared to do so, although Stopford concedes that, 'the charterers would simply not accept an uninsured tanker, unless they were desperate. So if there was a shortage and nobody would go up the Gulf, then they'll take anything.'[381]

Media coverage

There is also the question of media coverage and the political and public impact it could create. Media companies have become increasingly influential on public and political thought during conflict. The apparent ease by which journalists are able to accompany troops has led to a culture by which news reports from 'embedded' journalists can be aired in almost 'real time' by satellite links. The impact on the viewing public and the relationship between the military and media companies is often called into question. Some commentators have accused the media of broadcasting misleading propaganda, while coverage has raised many journalists to celebrity status whose fame alone can influence opinion. Media pictures of burning tankers during the 'tanker war' were mainly provided by still photographs taken by crew members. The action took place in the middle of the Gulf making this an inaccessible location for journalists and photographers alike. The same situation is unlikely during a closure of the Strait of Hormuz. Journalists could resort to sailing with salvage teams, reporting on board naval vessels and tankers or chartering aircraft to report on events.

Qatar is now the home of Al Jazeera. Al Jazeera often broadcasts a differing perspective to those held by conservative State run Gulf media stations. The station, well known for its often dissenting views, would be well placed to report on events in the Gulf and thereby create weighted discussion and conflicting opinion among neighbouring Arab states. However some footage could be taken out of context. For example should an oil tanker be hit and catch fire this would provide quite spectacular footage, but may not project a realistic perspective on the whole event. Once again, as with insurance companies the media could further impact, disproportionately in certain situations, on the full extent of a closure. Recent events in Tunisia, Libya,

[380] Hooton, E.R, Navias, Martin S, *Op cit,* p. 98.
[381] Interview with Martin Stopford 08/03/2010. See appendices p. 333.

Egypt, Bahrain and Syria have proved that social media web sites are effective platforms on which civil society can demonstrate and eventually depose heads of state during a crisis.[382] Media coverage of a crisis in the Strait of Hormuz could in turn prove to be a catalyst for wider issues within the Gulf to be addressed.

The probable effect of a closure of the Strait of Hormuz

A closure of the Strait of Hormuz would cause a termination of revenue, trade and trust as Stopford argues

> **The Middle East I think would be left with a major stigma and it would of course have massive effects for them...I think the loss of Middle East oil supply would cause a very major international crisis...there isn't an alternative supply that could take up the slack that you'd lose there.**
>
> **I mean you're in a war situation. If somebody closes the Gulf, you're in a war situation and it's about the most abusive thing that you can do. It strikes right at the heart of the Western and Eastern economies, so I would have thought there would be crisis measures.**
>
> **The rule of thumb in the industry is that you do well out of wars at least initially, just because it disrupts things and when things get disrupted, tanker owners find they're going to the wrong place, they're hanging around, there's congestion, there's storage, all of these things.[383]**

Of primary importance would not only be the lack of oil but the equally damaging loss of dollar revenue which would not only affect the economies of effected export states, but also the currency, stock and futures markets worldwide.

The fate of empty and loaded tankers trapped in the Gulf

Oil production within exporting states would continue only until the storage facilities were full. After this point it's highly probable that empty tankers trapped in the Gulf would be hired to create additional storage. The situation surrounding any tankers

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[382]Tapscott, Don, *Social Media Can Help Build Arab Governments Too*, http://www.huffingtonpost.com/don-tapscott/egypt-social-media-_b_865862.html
[383] Interview with Martin Stopford 08/03/2010. See appendices p. 326.

that have already loaded oil for export would be, according to Stopford, far more severe

> **[I]f you've got a closure like this, then you have to assume that there's been a degree of nervousness before. And if so then the price of oil would have gone up and therefore you're sitting on two million barrels of oil and a VLCC, which if it's a 100 dollars a barrel, two million barrels, 200 million dollars of capital, so the question I would think you ask is how do companies caught in that way, deal with funding the working capital on oil that they have purchased and can't sell and would the insurance companies cover them and what would be the consequences from that point of view and I think that would be commercially disastrous for people, if it was anticipated this would be a lengthy period. the first thing you do is check out where the ship is as quickly as you can and make sure you get it into a jurisdiction where you've got some sort of legal control and Saudi is usually the example that's given of one of the countries where you want to avoid if possible.**[384]

Companies and traders caught with a huge mortgage for the cargo may face repossession by the lender. In such a case the vessel could be 'arrested' in port although as argued by Stopford this can be problematic in a Saudi port. Due to Saudi adopting the principle of Sharia Law and the difficulties involved in translating Sharia into international law, as Martin Stopford put it '[I]t is rule number one that you do not arrest a ship in Saudi Arabia'.[385] Stopford further adds regarding the legal process

> **The process of enforcing a mortgage involves taking it to a court, which recognises the sort of legal system used by the banking industry, which is mostly British, a derivative of British Maritime Law and that's what most of the flag states use and you would have to have a regime that could, that would enforce that and as I understand it, you know a Saudi court wouldn't enforce it.**[386]

Another complication would be that trapped tankers would look towards their 'flag state' for protection which would invariably include a mixture of western and 'flag of convenience' states, all offering differing levels of commitment. During the 'tanker war' the US allowed Kuwait to 'reflag' eleven of its tankers and fly the American

[384] Interview with Martin Stopford 08/03/2010. See appendices p. 328.
[385] Interview with Martin Stopford 08/03/2010. See appendices p. 330.
[386] Interview with Martin Stopford 08/03/2010. See appendices p. 331.

flag.[387] Such an act would be unlikely immediately before or during a closure of the Strait of Hormuz. Acts of aggression by Iran against reflagged American tankers could force Washington to be drawn into numerous incendiary situations that may be seized upon by Tehran and used to escalate conflict to a higher level.

Worldwide tanker shortage

Tankers trapped in the Gulf would also create a shortage of available tonnage. Tankers arriving in the Indian Ocean hoping to enter the Gulf at a rate of twelve to fifteen a day would have to weigh anchor, resulting in the loss of yet more available tonnage although the charterer could still be bound to pay the agreed daily rate for the duration of the disruption. During the 'tanker war' as many as forty tankers sat empty waiting to enter the Gulf. For the industry as a whole the immediate priority would be to find alternative suppliers. Refineries around the globe would still be running and trying desperately to avoid a costly shut down. However, many alternative smaller producers' loading terminals cannot accommodate large tankers. So even though spare large tankers were available for charter, they would not be able to load elsewhere to ease the shortage, prompting Martin Stopford to comment that in such a situation 'I would rather have a small ship than a big one'.[388] Furthermore, if the closure took place after 2015 then any spare single hull tankers could not be chartered on journeys ending in EU or US ports due to environmental regulation banning their entry.

Empty tankers approaching the Gulf may therefore be diverted to alternative suppliers wherever possible. Vessels that could find alternative loads would, due to the lack of available tankers be able to command a higher freight rate. Loaded tankers that left the Gulf narrowly missing the closure would be contractually bound to honour the set freight rate although the fate of the cargo would fair differently

> **People would probably start storing oil as much as they could at sea, you know people tend to hoard when prices go up, because the price of oil would go to an undetermined**

[387] Hooton, E.R, Navias, Martin S, *Op cit,* p. 132.
[388] Interview with Martin Stopford 08/03/2010. See appendices p. 327.

level, so the speculators would come in and start storing oil and that might very well result in stocks being held at sea.[389]

It would most probably be the case that such hoarding would immediately affect the price of oil as opposed to the actual shortage caused by a lack of exports from the Gulf. To the market the shortage would therefore appear amplified which would corrupt price stability.

The reaction of oil traders

Trading during past crises has seen cargo's change hands on the open sea as much as fifty six times before discharging the oil. Trading would typically become just as volatile in a closure scenario if left to its own devices. Available oil could be bid over until it was left in the hands of high risk taking traders. Importing governments would be faced with a situation where the market would be left to determine the severity of the situation. Stopford argues that one way to stabilize prices would be for governments to take control the markets by regulating all oil at sea.

I mean basically if you've got a major stand-off...you'd have panic. Would it be left to the market? Or would they say this is such a serious thing, that we're going to basically nationalise all oil at sea? Then those ships would become under the control of the Governments, as they have done in wars previously.
I think basically you would have massive oil instability...this isn't oil that's owned by big responsible oil companies, it's oil that's owned by traders all sorts of people and it may be that there would be some sort of intervention.[390]

It would not only be oil importing states that would suffer. Iran, although a major producer, does not have its own refining capacity. Iran imports finished product from over forty countries. Whether Iran could make an undertaking to satisfy domestic demand and write off any potential export revenue during a closure would no doubt be a major factor in Tehran's decision to close the Strait of Hormuz in the first place.

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[389] Interview with Martin Stopford 08/03/2010. See appendices p. 327.
[390] Interview with Martin Stopford 08/03/2010. See appendices p. 332.

Preparing for the unthinkable

The full impact of a closure of the Strait of Hormuz is likely to be determined by the length of the closure, as opposed to any oil lost as a result of hostilities, during the disruption to supply. If Tehran were to develop a nuclear capability and design a rocket with which to deliver a nuclear weapon then as further affirmed by Barnes and Myers Jaffe 'A nuclear Iran would be in a much stronger position to assert its geographic leverage over the Strait of Hormuz'.[391] Should the threat take place in this context – a Bayesian shift away from conventional to nuclear weapons – then as argued by Stopford the effect should not be underestimated

> **I mean basically if you've got a major standoff, which looked as though it was going to drag on and people are notoriously bad at judging these things, I mean nobody really knows – I mean you'd have panic. We've seen it in the recent crisis, you saw it in the 1956 crisis, that people panicked and the belief of the oil companies, well documented belief of the oil companies after the Suez canal closed in 1956, was that it would be closed for four years, because they didn't believe that Egypt was capable of actually managing the canal and clearing it. While in fact you know it turned out that Egypt cleared it by the following April, so it was no sweat and people lost very heavily on that.**[392]

Whereas Egypt managed to clear the Suez Canal of trapped vessels, in order to determine the full effect of the closure of the Strait of Hormuz there has to be an investigation, however remote the probability, into the seemingly improbable position where Iran is able to hold and sustain a closure for an undetermined time, Stopford again

> **You've got a complete nightmare scenario and anyway you've got no money coming in and every day you don't sell anything, so if it goes on for a year, you're going to have a siege economy in the Gulf I would think.**
>
> **I mean if you want to explore this one, look at the cash flow of these oil states. They all have big budgetary commitments and you know Saudi export six million barrels a day of oil, seven, eight million barrels a day of oil and if that stops, then from the day it stops, they stop getting any money in. So suddenly the Gulf is without any visible means of**

[391] Barnes, Joe, Jaffe, Amy Myers, *Op cit,* p. 153.
[392] Interview with Martin Stopford 08/03/2010. See appendices p. 326.

support. It can't export from its – you've got Saudi with its chemicals, you can't export your chemicals, you've got your oil refineries in the Gulf, which can't export, which are relying on that, you've got no containers coming in, so you can't repair your cars, because you've got no spare parts.

The food supplies into the Gulf, man cannot live on oil alone and so there'd be no container ships in there and so basically you would be subjecting the Middle East to the – except possible Saudi bringing stuff through the Red Sea, to the same sort of crisis that you had by putting sanctions on Iraq, only worse really.[393]

Stopford quite rightly points out that Kuwait, Bahrain, Qatar and the United Arab Emirates rely on the Strait of Hormuz for trade and supplies that maintain the infrastructure, economy and lifestyles of their respective inhabitants.

The plight of the smaller Gulf States

Qatar and the UAE in particular are no longer sleepy backwaters and have far more at stake now than a decade ago. Their rise on to the world stage has been meteoric. Doha, Abu Dhabi and Dubai have become recognised hosts for international sporting events. They also provide tax havens, luxury accommodation, property and business investment opportunities for hedge funds and the worlds rich and famous. Collectively they rely on regular 'just in time' imports to sustain a seamless 24/7 lifestyle choice for those who can afford it. Left without access to their respective Gulf ports these states would be dependent upon overland supplies via Saudi Arabia. However, given the bureaucracy, strict controls and general lethargy attached to processing vehicles at Saudi Arabia's overland borders, not to mention the lack of infrastructure to accommodate a sudden increase in trucks, supplying the smaller Gulf States via Saudi Arabia may cause unwelcome friction. The other alternative would be to supply the isolated Gulf States by air as was the case with Berlin during the 'Berlin Airlift'. However, considering that all export revenues would cease, the cost of such an operation would be prohibitive over any prolonged period.

[393] Interview with Martin Stopford 08/03/2010. See appendices p. 327.

More worryingly Qatar and the UAE may be more inclined to sympathise with Iran if Tehran offered to treat them more favourably. Tehran could offer Iran as a transit land bridge. Seaborne supplies for the Gulf States could land at Chah Bahar Iran's main Indian Ocean port, travel overland through Iran then sail again from Iran's Gulf ports. Such an agreement may give the smaller Gulf States the confidence to break away from any reliance on Saudi Arabia as an alternative supply route. If Tehran could offer Qatar and the UAE independence from Saudi Arabia then the power of opinion, concerning for example lifting any sanctions on Iran, afforded to Doha, Abu Dhabi and Dubai would increase greatly during a disruption of this kind. Similarly regarding alternative supply routes, Bagdad was given the confidence to invade Iran in September 1980 after negotiating with Amman access to the Red Sea port of Aqaba in Jordan to supply Iraq during the conflict.[394] Conversely in deciding to rely instead on Saudi Arabia the Gulf States may feel pressured into following any policy move by Riyadh surrounding a closure, again possibly causing friction between respective heads of state and Riyadh not to mention at home, where policy could contradict with that held by their respective naturalized and ex-pat population.

Pipeline possibilities

The same could be said about oil exports from Qatar, Bahrain, Kuwait and the UAE. To offset any future disruption in the Strait of Hormuz pipelines could be built overland from Qatar, Bahrain, Kuwait and the UAE, through Saudi Arabia to the Red Sea. However, the same political arguments over dependency and leverage resound. Saudi pumps oil from the eastern oil fields to Yanbo on the Red Sea coast but the pipeline is relatively small and does not have the capacity to deliver oil for export on a par with Saudi's main export terminal at Ras Tanura on the Gulf coast. The effectiveness in a rise in traffic at Yanbo would also be dependent on whether the SUMED pipeline had the capacity to accommodate the extra volume. The SUMED pipeline pumps excess oil from Suez to the Mediterranean that would, if not removed from large tankers, prevent them from transiting the Suez Canal because the extra weight would cause the hull to ground out on the bottom of the canal. Stopford argues that pipelines could prove too vulnerable in any respect

[394] Hooton, E.R, Navias, Martin S, *Op cit,* p. 37.

Anybody who is resolute to close the Strait of Hormuz would probably be able to cope with pipelines pretty well too, so on the face of it, I don't see that being a real solution in any sense actually.[395]

There is also the possibility that if alternative pipeline routes were built to augment reliance on the Gulf, it may be seen that a closure of the Strait of Hormuz would not be so catastrophic. At first glance alternative export routes may appear to be a viable solution but conversely they could prove to be a grave mistake. As the Strait of Hormuz is the sole main export route on which so much rests it allows Washington a single platform on which to concentrate security. The addition of several other export routes would multiply the probability of a disruption and by default stretch not only Washington's military resources but those of the tanker industry as well.

Russian roulette – a multiple closure scenario

The final 'worst case scenario' assumes that Iran possesses the required leverage to conduct a naval exercise or series of exercises that would effectively close the Straits of Hormuz to tanker traffic on a number of unpredictable occasions. The situation is thickened by Iran inviting an oil exporting ally, for example Russia, to join the exercise. The Scenario includes Russia agreeing to make available surplus oil for export during the duration of the exercise in order to fulfil market demand, which would be payable in several currencies not only dollars.

As far as examples go, this scenario would be a well-planned strategic insult to US interests – while at the same time fulfilling the demand of other major importing countries. The addition of Russia would reduce the possibility of conflict, the oil market would be fulfilled and dollar exchanges could fall. But the scenario fails on the count of supply. In order for tankers to lift oil at Russia's main Black Sea loading terminals it requires them to navigate the Bosporus Strait. Tankers negotiating the Bosporus Strait are limited in size to vessels under 300 meters long.[396] This being the case, the Bosporus could not accommodate any spare VLCC's chartered on regular Gulf

[395] Interview with Martin Stopford 08/03/2010. See appendices p. 339.
[396] http://www.arkas.com.tr/en/straits_navigation.html

sailings that would become surplus during the exercise. So, even if Russia produced enough oil to cover that lost during the exercise there would not be enough spare tankers of the right size to lift and export it to the open sea via the Bosporus. The scenario therefore further emphasises the strategic nature of the Gulf to the shipping industry. Without the Gulf, shipping companies are left with empty vessels on their books that they cannot charter to alternative destinations because they are simply too big to be accommodated along divergent transit routes or in exporters loading terminals.

The stigma attached to a closure

The ultimate cost of a long term sustained closure of the Strait would be borne by exporters and consumers alike. The stigma attached to Gulf exporting states could spread doubt among consumers. This stigma may well extend to doubt concerning any future investment in the region. Regardless of proven reserves and the ability to produce oil the doubt would fall on producers being able to export consignments on a reliable, regular basis. As discussed above, a curtailment of oil lifting's from Gulf export terminals would seriously disrupt tanker movements, the repercussions of which would greatly impact on the oil market. If it becomes apparent that Iran will definitely acquire the capacity to close the Strait of Hormuz, Saudi Arabia and other exporting states could consider the possibility of increasing their own security by inviting major consumer states to take ownership of their gathering (pipeline) systems and export terminals.

If producer states were to privatise their respective oil infrastructures allowing consumer states a stake in the physical supply chain then the new consumer owners would be bound to protect these assets and therefore feel entitled to keep them productive. The impetus for upholding this entitlement would come from the weight that oil plays on consumer economies and the stability transactions contribute towards keeping the dollar stable. However this may not be enough to secure the need for a confrontation with Iran.

If it were perceived that Tehran would retaliate with a nuclear strike on Israel for example then there could be a stalemate or 'who blinks first' stand-off similar to the

one experienced by Moscow and Washington during the Cuban missile crisis – with the Strait of Hormuz possibly playing piggy in the middle. The backdrop for any favourable outcome regarding a closure to the Strait of Hormuz may ultimately rely upon the position participants take in other unpredictable events happening elsewhere in the world at the same time as the closure.

Conclusion

There is currently a very low probability of a closure of the Strait of Hormuz taking place. However, should Iran succeed in developing the potential to apply leverage on the Strait then a closure could become a reality. Analysis has also underscored the vulnerability with which the oil market is exposed to potential disruptions and shortages, purely due to the size of available tankers. Winston Churchill stated that 'safety and certainty in oil lie in variety, and variety alone.'[397] With hindsight he could also add that this not only includes producing states but the size of oil tankers as well.

At best a closure of the Strait of Hormuz would be devastating for Gulf oil exporting and consumer States and any foreign investments in the same producing countries, possibly leading to a long-term decline of market confidence in Gulf oil. The 'ripple effect' resulting from a closure would have far reaching social and economic consequences. At worst the closure of the Strait of Hormuz could trigger a nuclear standoff.

Interwoven within a decision to retaliate against Iran would be a mêlée of public opinion fuelled by media comment, speculation and exposés. Never, in the history of the United States have Washington's decisions been analysed, criticised and demonstrated against by the American public more than since the 2003 invasion of Iraq. Should the US clash with Iran over the Strait of Hormuz the outcome could well force the hand of the incumbent President to struggle against elected policy. Tehran may yet again play an unwelcome role in deciding whether the Democrat or Republican Party wins the post event Presidential election.

[397] Yergin, Daniel, *Op Ibid,* p. 144.

Terrorism

Prior to 9/11 the Gulf oil supply had been predominantly disrupted by war or issues regarding transit tax. Actual physical damage to the oil infrastructure was rare but not unknown, three notable examples being in 1970 when Syrian construction workers damaged the Tapline while laying a telephone line, a fire in 1977 at the Abqaiq pumping centre in Saudi Arabia, and the destruction of the Kuwait oil fields by retreating Iraqi troops in 1991.[398] Given the secrecy within the Gulf States there is also the distinct possibility that other accidents took place that remain unreported. However, the fact remains that physical damage to the oil infrastructure has generally been a threat as opposed to reality during inter-state conflicts in the region. This position is both a blessing and a curse in that importing States have grown accustomed to a regular supply during conflict, while on the other hand if it were to be proved necessary, protecting the vast infrastructure would be costly and problematic for all concerned.

The prospect of post 9/11 terrorism in Saudi was the first time the Kingdom has been faced with political violence from its own citizens. The Kingdom's response however was far from lacklustre. Saudi counter terrorism experts continued to thwart attacks, and the Kingdom's Armed Forces turned en masse to protect the Kingdom's oil infrastructure.[399] The Washington Institute went as far as to say that 'In theory, Saudi oil facilities are among the best guarded installations in the kingdom. The state owned company, Saudi Aramco, employs what is effectively a private army to provide security.' Riyadh fulfilled its obligations and the actions of the Saudi security forces no doubt helped restore circumspect Saudi – US relations.

Initially though from a geopolitical context the situation was far from settled. The hysteria which followed in the wake of 9/11 questioned existing confidence in Saudi Arabia as a safe place to do business. Projected analysis placed the Kingdom squarely at the centre of terrorism aimed at the oil industry.[400] In 2002 the Washington

[398] See Chapter 2 for further details
[399] England, Andrew, *Saudi set up force to guard oil plants,* Financial Times, London, 27/07/2007.
[400] http://www.energytrendsinsider.com/2010/10/04/oil-infrastructure-and-terrorism-part-i/

based Institute for the Analysis of Global Security released a synopsis of the potential threat from Al-Qaeda

> **Particularly vulnerable to oil terrorism is Saudi Arabia...Al Qaeda is well aware that a successful attack on one of the kingdom's major oil facilities would rattle the world and send oil prices through the ceiling...Whereas land targets are relatively well protected, the super-extended energy umbilical cord that extends by sea to connect the West and the Asian economies with the Middle East is more vulnerable than ever.. a single burning supertanker and its spreading oil slick could block the route for other vessels...Worse yet would be several such attacks happening simultaneously in multiple locations worldwide.[401]**

The alarming statement, along with many other similar predictions proved over subsequent years to vastly overstate the potential for terrorism in the region[402]. Analysis failed to take into account the operational ability of terrorists, the resilience of oil tankers and the wider oil infrastructure, and more importantly, the extent of any damage caused by terrorists that would interrupt the oil supply.

In December 2004 Osama Bin Laden delivered a message which affirmed Al-Qaeda's commitment to disrupting the Saudi oil exports, reminding followers to 'be active and prevent them from reaching the oil, and mount your operations accordingly, particularly in Iraq and the Gulf, for this is their fate.'[403] Bin Laden's appeal drew scant support. Such a call was a massive undertaking for his followers to take up and make any significant impact on supply. By the time of writing this thesis Al-Qaeda had mounted successful attacks aimed at industry personnel, which will be discussed later in the thesis, and one unsuccessful land based operation targeting the Kingdom's Abquiq pumping facility[404]. Al-Qaeda was also held liable for damaging the MV Limburg oil tanker anchored off the Yemeni coast.[405] Despite the infrequency and random nature of attacks expert opinion continued to favour an increase in terrorism.

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[401] Korin, Anne, Luft, Gal, *Terrorism goes to sea,* Foreign Affairs, Washington, November-December 2004, p. 54.
[402] http://www.abc.net.au/lateline/content/2004/s1124195.htm
[403] Daly, John C. K, "Saudi Oil Facilities: Al-Qaeda's Next Target?" Terrorism Monitor 4, Issue 4 (February 23, 2006).
[404] Al-Rodhan, Khalid R, *The Impact of the Abquaiq Attack on Saudi Energy Security*, CSIS, Washington DC, 27th February 2006
[405] Anon, Craft 'rammed' Yemen oil tanker, BBC, http://news.bbc.co.uk/1/hi/world/middle_east/2303363.stm

Even as late as 2006, a Centre for Energy, Petroleum and Mineral Law and Policy report commissioned by the UK Economic and Social Research Council stated that terrorism would be a 'high probability' cause of future disruptions.[406] Given the lack of terrorist operations in the previous five years the question of methodology behind these, and other claims must be questioned. The oil industry did not see terrorism in quite the same light. Oil majors like BP, Shell and Texaco mentioned the threat of terrorism in an annex at the rear of their Security and Exchange Commissioning filings. With this in mind the role of lobbyists offering scenarios and their impact on policy is examined later on.

It could also be said, some may say rather cynically, that the continued threat of terrorism in the region had lucrative commercial interest. The atmosphere of fear did manage to generate a lasting fear in the region, and beyond, which became known as the 'Terrorism Industry'.[407] The terrorism industry was fuelled by private security firms hired to train personnel, guard critical infrastructure, write practice and procedure manuals and audit ongoing domestic and internationally agreed security codes and practices, all be it against an apparently benign threat.

Resilience and methodology: lessons learned from the past

In a similar exercise to that applied earlier in the thesis while analysing the resilience of oil tankers, a great deal of insight can be gleaned by examining the circumstances surrounding major industrial accidents. What becomes apparent through the case studies, as was the conclusion with oil tankers, is that internal failures produce the most destructive results than damage sustained from an external force. Furthermore, as with tankers, the circumstances preceding the blast would be extremely difficult to replicate by a determined saboteur. A key contributing factor being that explosions occur after a single part has failed within the facility which in turn applies pressure to the whole system. Let us not forget at this point that oil industry personnel often work in extremely hazardous conditions with highly inflammable substances that would to a layman appear too dangerous to work in. The difference being that well trained and

[406] Centre for Energy, Petroleum and Mineral Law and Policy, *Security of International Oil and Gas: Challenges and Research Priorities: A Project for the Economic and Social Research Council.* CEPMLP, Dundee, 2006, p. 2.
[407] Term used by Edward S Herman and John Mueller among others.

risk aware personnel are attentive to any possible hazards whereas a layman can only rely on limited technical knowledge and their imagination.

The following dramatic and lethal incidents aim to exemplify the difficulty a terrorist would face replicating a similar attack. In 1974 the Nypro UK owned chemical plant at Flixbourgh exploded.[408] A pipe carrying cyclohexane ruptured and released enough gas to form a cloud which ignited and killed 28 workers. Nature contributed to the devastating effect in that the release happened on a calm day and therefore the wind did not disperse the cloud. A single pipe caused the Flixbourgh disaster in an area of the plant that was difficult to reach and would have required time, specialist tools and technical knowledge to detach. A part failure also caused the Piper Alpha gas platform to explode in 1988 killing 162 workers. The part in question, a valve, had been blanked off during maintenance. However, due to a misunderstanding at a critical shift change gas continued to be pumped through the valve until pressure backed up through the system and caused an explosion.[409] Incomprehensibly neighbouring platforms continued to pump gas to the stricken Piper Alpha as shutting the system down would incur a heavy cost and therefore a fear of disciplinary action to those concerned. As with Flixbourgh optimum damage resulted from defective parts and in the case of Piper Alpha human failure.

Oil refineries have suffered a similar fate. Explosions at Grangemouth, Scotland in 1976, Milford Haven, Wales in 1996 and the 2005 US Texas City refinery were all caused by parts failure. Typically, in all three cases flammable vapour ignited; in the case of Texas when a worker tried to start his car and move it to safety.[410] There is no definitive answer as to whether a terrorist could replicate a similar incident but the evidence points to a pattern involving a small part failure which the system further exasperates with pressure, resulting in an explosion. Terrorism did enter the equation in 2005 though after the huge explosion and subsequent fire at Total Oil's Buncefield storage depot in Hertfordshire UK. The fire came at a time of heightened alert, but terrorism was very quickly ruled out after it became apparent that due to a faulty gauge petrol overflowed from vents in a storage tank and formed an explosive air/vapour mix

[408] http://www.hse.gov.uk/comah/sragtech/caseflixboroug74.htm (06/03/2011)
[409] http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/HS048.pdf (06/03/2011).
[410] Morrison, Kevin, *BP Texas Refinery Explosion,* Financial Times, London, 25/03/2005, p. 3.

which ignited from an undetermined source.[411] Again, the cause of the incident was relatively subtle as opposed to the drama associated with terrorism.

The information held above emphasises in each case the unique set of circumstances which contribute to the unfolding catastrophic incidents. Something that is not mentioned above is the plethora of reported near misses and accidents which were averted before they became critical. Paradoxically, when deciding the rationale for upholding the security of strategic locations and critical infrastructure, policy makers refer to previous accidents as a comparison, omitting the fact that they are worst case scenarios and overlook the intricate technical nature behind the disaster. The methodology behind such policy points towards appeasing social anxiety as opposed to taking scientific analysis in to account first. When therefore applying Bayesian methodology to terrorism aimed at the Saudi oil infrastructure the result is far more conservative than popular opinion predicted. Two major incidents discussed next that Al-Qaeda executed highlight the strength of Bayesian prediction.

[411] Lord Newton, *The Buncefield Incident- the final report of the major incident investigation Board,* HMG, 2008, p. 125.

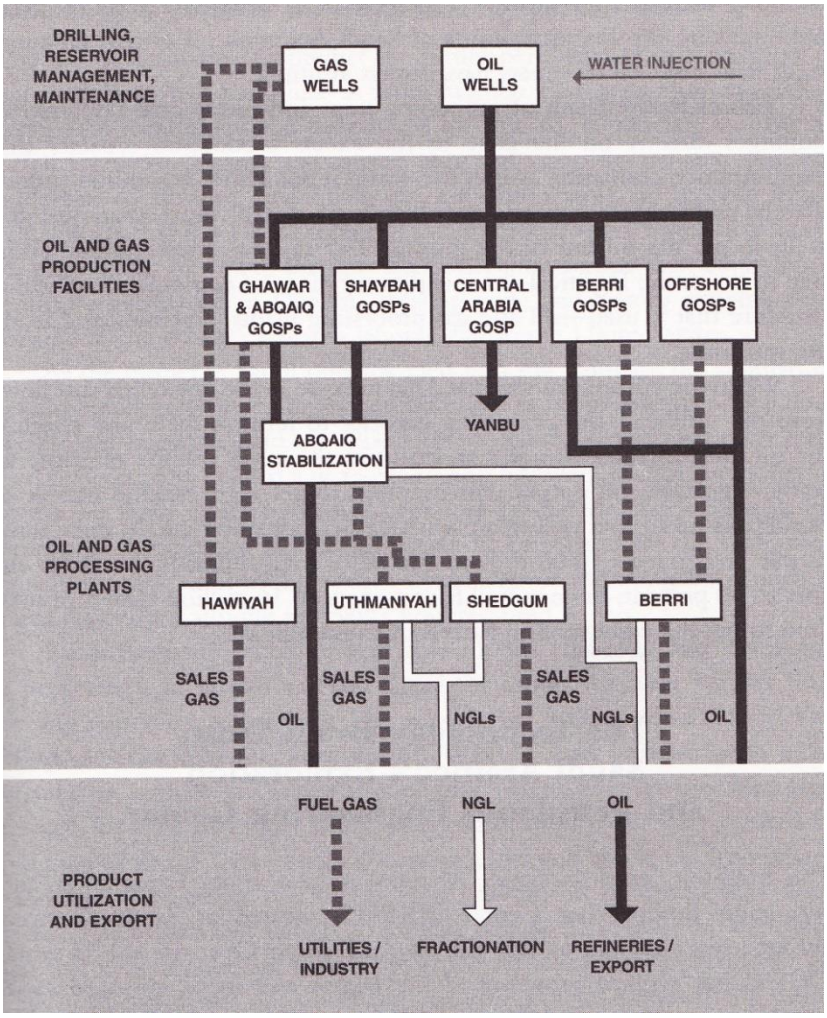

Fig 6.4 Abqaiq stabilization facility

In February 2006 Saudi security forces foiled an Al-Qaeda suicide attack aimed at the Abqaiq stabilization facility in the Eastern Province. The terrorists managed to penetrate through security cordons in two cars laden with explosives before being killed by guards. Both cars exploded but the damage was slight and limited to facilities near the perimeter fence. News of the attack raised oil prices by $2 a barrel.[412]

As shown in the diagram above Abqaiq is placed in a strategic position in the Saudi oil supply chain. The facility pumps approximately 7 million barrels of crude a day. A previous fire in 1977 caused a production loss of 330,000 barrels a day spread over a six month period. Al-Qaeda chose their target well but in reality even if the attack had

[412] Al Rodhan, Khalid, *The Impact of the Abqaiq Attack on Saudi Energy Security,* CSIS, Washington, 27/02/2006, p. 3.

been successful, would the impact have been the same? A build-up of corrosion within the system caused the 1977 fire. As such the damage was widespread, the system failing only when parts could no longer cope with the blockage, causing further collateral damage 'down the line'. A bomb would no doubt destroy part of the facility but the blast would impact on the outside of the infrastructure rather than incur damage from within. The $2 price rise is therefore not a clear representation of the risk attached to the facility but in effect a geopolitical tax or 'security premium' calculated purely on fear.[413] In this case, win or lose, Al-Qaeda reached their objective. The market amplified the attack. At ground level it could be said that although individual facilities may be vulnerable the infrastructure remains resilient – a sentiment echoed by Farzin Nadimi in his treatise of the vulnerability of Kharg Island's oil production facilities during the Iran-Iraq war.[414]

MV Limburg

Akiva Lorenz was not alone when he forecast that

> **In the near future we will witness more maritime attempts to disrupt the oil flow in the Persian Gulf and against cruise ships...Maritime terrorism is positioned to be their [Al-Qaeda] method of choice.[415]**

Again, the prediction never quite lived up to expectations. The suicide attack on the MV Limburg discussed earlier in the thesis remains the only example. The tanker industry remained relatively unmoved after the attack. Taking the wider shipping industry into account Martin Stopford argued that '[I]t's a bit like sort of chucking a stone at somebody, it's an irritant.'[416] Stopford was far more keen to emphasise the rise in piracy but when pressed he summed up his position

> **The amount of terrorism against merchant ships has been fairly modest, as far as I can remember. I can't think of hardly any examples actually and all I can think is that given your fair point, that this is something that you might very well have expected, then probably the explanation is a practical one, that's when terrorist sit down and think of**

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[413] Brown, Stephen P. A, Huntington, Hillard, *Reassessing the Oil Security Premium,* RFF, Washington, 01/02/2010, p. 1.
[414] Nadimi, Farzin, *Kharg and the Iran-Iraq War,* Manchester University, Manchester, 04/07/2007, p. 21.
[415] Lorenz, Akiva, *Al Qaeda's Maritime Threat, http://wikileaks.org/gifiles/attach/8/8953_AlQaeda%20MaritimeThreat.pdf,* p. 20.
[416] Stopford, Martin, interview 08/03/2010

targets, they look at ships and they think well you know where does this get us...it's not a very elegant way of committing hari kari you know?[417]

The industry appears to rest its case. There was however one spurious incident that took place in the Strait of Hormuz. In July 2010 Japanese owned tanker the MV Star sustained damage while steaming south through the Strait.[418] The United Arab Emirates issued a statement blaming a 'freak wave'. Further examination by experts attributed the damage to explosives, with terrorists identified as the culprits. Given the strategic nature of the Strait the response was curiously muted. The incident drew scant attention from the tanker industry and policy makers alike. It may be the case that when shaping policy real life situations are not enough, and give way to scenarios aimed at priming emotions instead.

Scenarios, policy and the 'terrorism industry'

The Heritage Foundation modelled a series of scenarios in 2008 and 2010 analysing the impact of co-ordinated terrorist attacks.[419] The scenarios took place sometime after the initial 'heat' of any expected terrorist action. The scenarios are probably best described as industrious but highlight the distance between influencing policy and the practical constraints faced by a terrorist organisation mounting such attacks. A synopsis of the scenario's below details the scope.

Al-Qaeda takes 300 pupils hostage at the Ras Tanura Middle School. The next morning the hostage-takers begin executing students.

While Saudi security forces are distracted, al-Qaeda launches simultaneous attacks on oil-processing and shipping facilities. These are thermobaric explosive attacks on the Ras Tanura and Abu Qaiq facilities, destroying parts of each. (Improvised thermobaric weapons are containers of fine explosive particles or liquids that burst open the container and disperse the contents in a cloud and then ignite, creating a downward destructive wave of over-pressure.)

An explosives-laden plane attacks the Saudi Aramco headquarters, destroying the Internet facilities there and killing portions of the company's leadership.

Indonesia-based Jemaah Islamiyah begins speedboat attacks on oil tankers crossing the Strait of Malacca.

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[417] Stopford, Martin, interview 08/03/2010
[418] http://www.bbc.co.uk/news/world-asia-pacific-10890098
[419] A series titled 'The Global Response to a Terror-Generated Energy Crisis'.

Jemaah Islamiyah places EM-52 mines in the Strait of Malacca (near Singapore). The mines are coated with polymer to reduce the likelihood of detection.

All oil traffic through the Strait of Malacca is stopped because insurers will not give coverage to hydrocarbon cargo.

Al-Qaeda affiliates place mines in the Strait of Sunda to further disrupt traffic.[420]

After digesting the scope of the attacks it becomes immediately apparent that the scenarios lack credibility. They were simply labelled as 'preposterous' by one leading academic.[421] The enormous amount of data alone required to analyse such an event would be enough to bury any worthwhile responses gleaned from the exercise. To put a co-ordinated attack like the one above into the same inordinate context, during World War Two 'Operation Market Garden' which aimed to secure three strategic bridges in Holland involved 42,000 troops and over 4,500 aircraft. However, the scenario may have also understated the resilience of the oil infrastructure. During the war in Chechnya for example it took months of intensive pounding by Russian artillery and air force sorties to destroy the oil refinery in Grozny.

Moreover scenarios fail to include a wider geopolitical context. It is important to mention the response of world leaders to an act of terror. Al-Qaeda's attacks against oil installations in Saudi Arabia were not only operational failures but appear to be carried out on seemingly random dates that did not interrupt any planned event held by, or including, the Saudi Royal family or for that matter the US President. The stigma attached to terrorism carries such a high political value that world leaders cannot afford to ignore reported acts regardless of size.

The response of world leaders, the cancelling of engagements or planned state visits can be seen to only amplify the importance of the act in question. The aftermath often leads to resignations, cabinet reshuffles and negative media coverage, which in democratic countries can effect elections. Al-Qaeda failed to synchronise attacks in Saudi with major events elsewhere in the world but this was not the case in the UK. The July 7th 2005 bombings in London coincided with the G8 summit in Scotland. UK Prime Minister Tony Blair left the summit and returned to London commenting that the

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[420] http://www.heritage.org/research/reports/2008/11/the-global-response-to-a-terror-generated-energy-crisis
[421] Mueller, John, *Terror, Security and Money – Balancing the Risks, Benefits and Cost of Homeland Security,* Oxford University Press, Oxford, 2011, p. 128.

attack was in direct response to the G8 meeting he was hosting. Other commentators however argued that the bombers knew that on July 7th the Metropolitan Police were short staffed as many officers had been deployed in Scotland to act as security to G8 summit delegates.[422] Whether the attack was in response to the G8 summit or not, the terrorists benefitted from reduced police vigilance in London.

A further scenario oversight is the behaviour of financial and stock markets after acts of terror. The media can spread news of terrorist incidents around the globe in a matter of minutes. Traders can only react if the market they trade on is open. Given also that exchanges keep to strict opening hours trading after such an attack can give a false impression as to the magnitude and impact of the damage achieved. Traders who react negatively can find the exchange closes before the market has a chance to catch up. As other markets open around the world and more information regarding the terrorist attack is disclosed trading could ease off until 'normal trading is resumed' at exchanges six or seven time zones away from the first exchange to hear the news. The issue then resurfaces the following day when exchanges that closed before the full extent of the incident was revealed, open with markets still in the pre-existing down position for seemingly no other reason than panic.

The net result of overstating terrorism *per se* and the accompanying posturing has provided a litany of energetic material which, again, is based on assumption and implied premise rather than methodology and technically correct analysis. Lawrence Friedman went so far as to say that 'the development of the field of terrorism studies has, in recent years, appeared to outpace the development of actual terrorism'.[423] John Mueller took Friedman's comment a stage further and called it an 'industry',

> **[T]errorism is a rather rare and, in appropriate context, not a very destructive phenomenon as [often] argued...Nonetheless, the most common reaction to terrorism is the stoking of fear and the encouragement of overreaction by members of what might be called the "terrorism industry," an entity that includes not only various risk entrepreneurs and bureaucrats, but also most of the media and nearly all politicians. Thus, a problem with getting coherent thinking on the issue is that reporters, bureaucrats, politicians, and terrorism experts mostly find extreme and alarmist possibilities so much more appealing than discussions of broader context, much less of statistical reality.**

[422] http://www.theguardian.com/world/2005/jul/07/g8.uk
[423] Lawrence D. Freedman, short review of Richard English, Terrorism: how to respond (OUP, 2009)

> **Stephen Flynn, like others in the terrorism industry, likes to begin articles with such dramatic lines as "the United States is living on borrowed time--and squandering it," and end them with "the entire nation...must be organized for the long, deadly struggle against terrorism." He also admits that he often has to "fight back a sense of despair" and of "dread," and suggests that officials "must assume that our enemies will soon launch far more deadly and disruptive attacks" than those of 9/11 for which "the potential scenarios are almost unlimited.[424]**

It is not only academic institutions that overreact. George Bush Jnr's hastily assembled Homeland Security Department began its printed manifesto by announcing that "Today's terrorists can strike at any place, at any time, and with virtually any weapon."[425] The dramatic opening statement hides the fact that with almost limitless potential targets and so few active terrorists the likelihood of geographically being in a place that leaves you a victim of terrorism is diminutive.

Counter measures strayed in to the bizarre. In a bid to be 'ready for anything' the US Congressional Research Service produced a report titled 'Port and Maritime Security: Potential for Terrorist Nuclear Attack Using Oil Tankers'. The fact that a report was even commissioned on such an extraordinary subject is measure enough that the 'fear factor' regarding Middle East based terrorism was deeply entrenched in the US political psyche. The technical and logistical requirements alone are inscrutable given the operational capabilities of any leading terrorist organisation, the narrative is eye opening

> **To stage a nuclear attack using a tanker, terrorists would need to acquire a nuclear device and smuggle it (or key components) onto the ship. Their ability to accomplish this latter task would likely depend on their ability to infiltrate, bribe, or otherwise work around local security; on the reliability of security personnel in oil-exporting countries such as Saudi Arabia, Kuwait, and Algeria; and on the reliability of the ship's officers and crew. Terrorists might seek to place a nuclear device inside one of a tanker's oil tanks, which would require sealing and cushioning the bomb and possibly attaching it to the tank wall; or in a dry space on the ship; or in a blister attached to the ship underwater. Remotely detonating a bomb inside an oil tank or underwater might be difficult: it might not be possible to attach wires leading out to dry spaces, or to send an electromagnetic signal (e.g., a cell phone call) through water or oil to the bomb. Detonating the bomb with a timer would run the risk of the ship not being at the target at the specified time. Overcoming these challenges might be within the ability of a terrorist group resourceful enough to acquire an atomic bomb. Terrorists might also smuggle a bomb onto a ship at sea.[426]**

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[424] Mueller, John, *Simplicity and Spook – Terrorism and the Dynamics of Threat Exaggeration,* Ohio State University, Columbus, 2005, p. 47.
[425] http://www.foreignaffairs.com/articles/61911/john-mueller/is-there-still-a-terrorist-threat-the-myth-of-the-omnipresent-en
[426] Medalia, John, *Port and Maritime Security: Potential for Terrorist Nuclear Attack Using Oil Tankers,* CRS Report for Congress, 07/12/2004, p. 3.

The report later states that the intended destination of a potential nuclear bomb would probably be the Louisiana Offshore Oil Port (LOOP), eighteen miles off the US coast, limiting somewhat the damage any device might be expected to inflict on the area. Terrorists infiltrating crews is another contentious point.

Crews are predominantly comprised from citizens of third world maritime countries such as the Philippines and Indonesia. They are a close knit community with vacancies being filled by references provided from existing crew members who recruit from their own towns and villages. When the US government wished to replace the existing crew 'log book' with a universal seafarers ID card, seafarers unions pointed out that a log book was much harder to forge than it would be to 'clone' a new ID card. The seafarers ID card was subsequently dropped as a replacement to the log book. Seafarers are often exempt from requiring visas as the log book provides proof enough of their reason for entry and also as a means of additional ID when sending money to their home countries via wire transfer offices. Regardless of these points the Congressional report avoids the elephant in the room in that any terrorist organisation that had acquired a nuclear weapon would be unlikely to chance delivering it to the intended target via an oil tanker. There would no doubt be a number of alternative ways and means for terrorists to explore before resorting to remote offshore targets and oil tankers to deliver their message.

The desperate search for solutions became almost comical when the Department for Homeland Security paid for research to be carried out on honey bees to determine whether they could be employed as 'sniffer dogs' to detect weapons and explosives.[427] Although novel, the act can also be considered confusing in that traditional methods are just not enough anymore and the establishment is turning to even more audacious measures to ensure success. In a final point regarding extreme measures in 2005 private security firm Aegis Security acted as consultants to Lloyds. After consultation Lloyds declared the pirate infested waters of the Strait of Malacca in South East Asia a war risk zone.[428] The decision attracted huge derision resulting in the War risk status being dropped. The episode prompted one shrewd commentator to point out

[427] http://news.bbc.co.uk/1/hi/sci/tech/1986769.stm
[428] Carmola, Kateri, *Private Security Contractors and New Wars – Risk, Law and Ethics,* Routledge, Oxford, 2010, p. 72.

> **[I]t is a gross generalisation and a blunder to bundle the low-risk, high-impact event such as a terrorist attack with high-risk, low-impact act of piracy, especially when the likelihood of their nexus is...remote.**[429]

Due to the confused input of such organisations it is almost certain that policy makers have spent more time and energy analysing 'implied' threats than actual incidents. Implied threats fed by organisations to lobbyists can well be accused as promoting political strategies as opposed to widening the practical understanding of threat analysis. This tendency leaves a lingering expectation that Al-Qaeda in particular will punch way above their weight. The prompt being that national security requires the cooperation of the international community to succeed, which translates to individual governments funding private companies to implement global security projects – regardless of how effective the projects may be.

A good example of state funded private enterprise was the immediate and costly implementation of the International Ports and Ship (ISPS) Code after 9/11 which ultimately stood to prevent terrorists shipping a nuclear device in a sea going container. At a London ISPS conference in 2006 defence manufacturer QinetiQ unveiled a device that would send an alarm to a central control room should a container be opened in transit. A delegate then pointed out that shipping companies often cheat clients by selling them a single container for a single consignment only then to open the same sealed container at a warehouse and fill it with other goods bound for the same destination. There are hundreds of thousands of sea going containers in circulation so the probability would be that managing the alarm system would be a greater task than preventing a nuclear device from ever being shipped. Nonetheless private security services extol the need for the ISPS Code to continue as explained in this quote from London based Hart Security Services

> **Hart has trained over 2,000 Ship, Company and Port Facility Security Officers and has conducted more than 400 ship and port facility security assessments and developed their plans. We have advised numerous international ship and port operators on ISPS Code implementation including ongoing audit and maintenance.**[430]

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[429] Bobby, Thomas, *Malacca Strait a war risk zone – Lloyds should review its assessment,* Nanyang Technical University, Nanyang, 19/08/2005, p. 2.
[430] http://www.hartsecurity.com/maritime-security

The motivating word for commercial purposes here is 'ongoing'. Regardless of the ISPS Code's effectiveness in order for port or ship owners not to fall fowl of the law, the facility or ship needs constant checks and lucrative monitoring by a company like Hart[431]. Ironically Saudi Arabia is yet to implement the ISPS Code as it requires conversion into Sharia Law, therefore neutralizing the protection the code offered. In this form the security against terrorism offered by private security companies should not be confused with preventing individuals from becoming terrorists.

In summary Al Qaeda's perceived threat failed to materialise except for occasional isolated incidents which left little or no damage to the oil infrastructure. Any resulting long term impact on the political stage or financial markets was therefore lost to the organisation too. However, this state of affairs leaves a stark paradox. With so little reported action in the Kingdom since 9/11 it is quite astonishing that a 'terrorist industry' has grown from a bed of implied threat, and well respected organisations such as the Heritage Foundation choose to run and promote scenarios and exercises which hold practically no resemblance to the current scope and means of terrorist organisations such as Al-Qaeda.

Ex-pats

Overview

Oil revenue has encouraged Saudi Arabia to maintain a high dependency on ex-pat labour.[432] Although the ex-pat community may appear an unlikely threat to the KSA oil supply chain, such are their collective roles and sheer size of the community that the potential they hold should not be immediately discounted. Ex-pats are for the most part annexed from Saudi society and, in the case of domestic and migrant workers, generally poorly treated.[433] These issues alone are prone to causing resentment. The marginalisation of social groups in Northern Ireland, Israel, Turkey, Iraq and Spain has after all produced long running bitter feuds. The situation in Saudi Arabia differs in that the ex-pat community is invited to live and work in the Kingdom. Ex-pats based

[431] http://www.hartsecurity.com/maritime-security
[432] Al-Dosari, Saad, *A dangerous virus called 'expatriate Worker',* http://saudigazette.com.sa/opinion/local-viewpoint/a-dangerous-virus-called-expatriate-worker/
[433] http://www.hrw.org/world-report-2012/world-report-2012-saudi-arabia

in the KSA play no part in Saudi political decision making, have few rights or tangible support from the international community regarding their welfare.[434]

Saudi Arabia depends on a mixture of high and low skilled ex-pat labour employed in posts that are unattractive, too highly skilled or too expensive for Saudi nationals to fill. While not ignoring the plight of migrant workers or the lifestyle of Saudi nationals, the question this thesis asks does not concern the legitimacy of the treatment ex-pats receive but whether the actions of ex-pat workers could disrupt the oil supply. At first glance the locus of domestic and manual migrants in particular would encourage conflict. But, as the following analysis will reveal, regardless of their actions, skills and population the likelihood of ex-pat workers causing a disruption to the oil supply is currently very low indeed.

Growth of the ex-pat community

In 1963 ex-pats numbered 115,000 or 14% of the labour force.[435] By 1970 the number had risen to 320,000 or 27% of the labour force.[436] In the 1970's ex-pats were imported to carry out the 'middle class' indoor roles such as schoolteachers, doctors, nurses and accountants.[437] Manual and domestic migrant workers were also imported on a lesser scale than present. The situation changed after the 1973 oil price rise. Post 1973 industrialization encouraged employers to import technically competent foreign workers because they commanded a lower salary than Saudi applicants who held an exaggerated idea of their own value.[438] By 1979 ex-pat labour increased to 1,347,000 or 53% of the labour force.[439] Today the figure stands at approximately 7,000,000 or just under one third of the Kingdoms population.[440]

The majority of ex-pat labour currently residing in Saudi Arabia is provided by migrant workers from South East Asia and the Indian Sub-Continent. The posts held by

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[434] Vlieger, Antoinette, *Domestic Workers in Saudi Arabia and the Emirates: a socio-legal study on conflicts,* Quid Pro Books, New Orleans, 2011, p. II.
[435] Niblock, Tim, *Saudi Arabia: Power, Legitimacy and Survival,* Routledge, London, 2006, p. 54.
[436] Niblock, Tim, *Ibid,* p. 54.
[437] Lippman, Thomas W, *Saudi Arabia on the Edge: The Uncertain Future of an American Ally,* Potomac Books, Dulles, 2012, p. 107.
[438] Lippman, Thomas W, *Ibid,* p. 107.
[439] Niblock, Tim, *Op cit,* 2006, p. 55.
[440] Vlieger, Antoinette, *Op cit,* p. 38.

migrant workers are not the 'middle class' roles of the 70's. Today's migrant workers are employed in roles such as construction labourers, trash collectors, gardeners, taxi drivers and factory hands.[441] The treatment and social condition of migrants have for some time been internationally condoned for deplorable breaches of human rights. The status and salaries migrants command has been enough to dissuade Saudi nationals from competing for their jobs. Hertog and Niblock argue that this division has resulted in Saudi Arabia being a country without a national working class.[442] The Kingdom's continuing welfare subsidies have increased social dissonance in this area. Antoinette Vlieger describes cheap migrant workers as providing Saudi nationals with '[W]ealth and luxury, which keeps their citizens fairly content.'[443]

Dynamic of the ex-pat community

The extent on which the Saudi dependency on migrant workers lies is shared among three basic strata of ex-pat labour. Ex-pats from the West provide expertise in areas such as oil field support and technical services, construction and business management, academia, healthcare and banking.[444] Military training and consultancy also benefit from ex-pat labour. The US Vinnell Corporation trains portions of the Saudi Arabian National Guard.[445] The posts are attractive as they often guarantee tax free earnings on a legally binding contract of employment from the workers home country, private healthcare and the freedom to return back to the workers home country if required. Western ex-pats are generally housed in compounds where they have little contact with Saudi society.[446] This relationship works two ways. Compounds keep the reality of tribal and segregated Saudi Arabia away from Westerners while shielding Saudi society from 'Western decadence'. Despite the seemingly separatist living conditions overall Western ex-pats are respected as they work in important valued roles. There is one rather congenial anomaly to the rule. Due to the rather restrictive living conditions in Saudi many ex-pat oil workers live in the more relaxed environment offered by Bahrain and literally 'commute' to work.[447]

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[441] Lippman, Thomas W, *Op cit,* p. 106.
[442] Niblock, Tim, *Op cit,* 2006, p. 55; Lippman, Thomas W, *Ibid,* p. 107.
[443] Vlieger, Antoinette, *Op cit,* p. 162.
[444] Mackay, Sandra, *Inside the Desert Kingdom,* W. W. Norton and Company, New York, 2002, p. 9.
[445] http://www.irconnect.com/noc/press/pages/news_releases.html?d=182227
[446] Mackay, Sandra, *Op cit,* p. 9.
[447] This was certainly the case with US oil engineers I met at the SAOGE 2008 Exhibition.

Not only does the arrangement work but freedom of movement afforded to these workers does not extend to the vast community of lower status ex-pats.

Domestic and manual migrant workers

The following two groups of ex-pat workers are both classed as 'migrant workers'. The first group are commonly referred to as 'domestic workers' who are both male and female.[448] The second group consists of 'manual migrant workers' who are exclusively male.[449] Both groups of migrant workers originate predominantly from the Far East and Indian Sub-Continent. Domestic workers are recruited from Indonesia, the Philippines and Nepal. Manual migrant workers are recruited predominantly from India, Pakistan and Bangladesh although cross-over recruitment does exist.[450] Recruitment takes the form of sponsorship by an employer in Saudi Arabia and is facilitated through an agent. In the case of migrant workers, the home governments are complicit in their recruitment. Government bureaucracies not only assist applications but also rely on the fees for income. Once in Saudi Arabia the welfare of domestic workers is left to their employer who retains their passport.[451]

From a Saudi point of view the difference between Western ex-pats and migrant workers is so vast that the two groups are incomparable. Western ex-pats are discreet, affluent and valued. Migrant workers on the other hand are a constant reminder of the positions and jobs that are seen as demeaning. The role of a migrant worker may be collectively vital to Saudi society but one that, due to privilege, Saudi citizens see as being one they personally are not responsible for filling.[453] The apparent key role that ex-pats of all nationalities and abilities hold raises the question of their collective power in the Saudi State. The question can in part be answered if the circumstances of migrant workers in the West are compared to those of Saudi based migrants. In the European Union for example migrant workers are active in the civil society of their host country. Migrants can among other things claim residency, vote in local elections, introduce ethnic media, schools and businesses. In Saudi

[448] Vlieger, Antoinette, *Op cit,* p. 45.
[449] Niblock, Tim, *Op cit,* 2006, p. 55.
[450] Vlieger, Antoinette, *Op cit,* p. 173.
[451] Vlieger, Antoinette, *Ibid,* p. 300.
[453] Lippman, Thomas W, *Ibid,* p. 107.

Arabia migrants do not have these opportunities. Overall the terms and conditions applied to migrant employment make it almost impossible for Saudi nationals to consider working in the same roles.

Migrant workers and the social trammel

Abram de Swaan contests that the welfare of the poor in Europe came into existence when the poor began to cause problems for the more powerful part of society. De Swaan states that the poor in Europe were perceived as a threat by the upper class because they could become beggars or gangs of criminals.[454] The poor also spread disease. The diseases seemingly did not differentiate between class and a healthy poor increased productivity. The poor occasionally became angry about their fate and started strikes or uprisings which threatened the interests of their employers. The final reason posited De Swaan was the development of labour laws that were introduced during the industrial revolution to create equal competition and a level playing field in the emerging market.[455] The above reasons are not exhaustive but collectively they do provide a robust model to which the position of Saudi based migrant workers can be compared.

Health

The reluctance to provide healthcare alone removes a huge responsibility away from Saudi society not only by way of treatment and aftercare but also in the implementation of prevention policies. For example there is no basic standard to which migrant workers are housed or afforded access to water and sanitation. The ability to deport sick migrant workers and quickly replace them displaces the need for a welfare state that supports migrant workers. A further point to consider is that although workers may fall ill, the probability is that they will not all fall ill at the same time. This being the case, due to the limited amount of sick workers being deported at any one time, the authorities manage to contain and process sick individuals efficiently enough for diseases contracted by migrant workers not to affect Saudi society.

[454] Vlieger, Antoinette, *Op cit,* p. 67.
[455] Vlieger, Antoinette, *Ibid,* p. 69.

Goods for services

There would appear to be a growing case for migrant workers to complain against their treatment. However, there are several factors which prevent migrants from raising complaints. Domestic migrant workers are generally not allowed out of their employer's house.[458] Even if they manage to escape to a 'safe houses' run by the embassy of their home country a migrant can find themselves being returned to their employer or prevented from leaving the country because their employer has retained their passport.[459] Regardless of the many cases of trauma embassies deal with, embassy staff can only offer limited assistance. The link between a migrant worker's home country and Saudi Arabia is very strong as Vlieger explains

> **[G]overnments of labour-sending countries are more concerned with employment and remittances, which constitute a very large portion of their GNP. Moreover the IMF and World Bank apparently use remittance flows in their calculations of sustainable loans, and credit rating agencies such as Moody's, Standard & Poor's, and Finch do the same for their decisions on certain bond ratings. The governments of labour-sending countries do not want these remittances to diminish and therefore do not make a strong stand for their overseas workers.[460]**

Similarly Western countries concerned with Saudi Arabia's human rights record are also the same countries that supply the Kingdom with arms and technology. Such exports are so important to the economy that human rights concerns come second to securing business in the Kingdom. Under the circumstances the treatment, however poor, of domestic workers and the subsequent action of the domestic worker or home government is likely to have no affect at all on the oil supply if current conditions in the Kingdom prevail.

Civil unrest

Manual migrants may have more freedom but Sharia law prevents public demonstrations from taking place. At worst troublesome migrants are jailed and deported. Antoinette Vlieger argues that since communism is no longer viewed as an attainable ideal Saudi society is less wary of the danger posed by radical labour

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[458] Vlieger, Antoinette, *Ibid,* p. 341.
[459] Vlieger, Antoinette, *Ibid,* p. 341.
[460] Vlieger, Antoinette, *Ibid,* p. 172.

movements.[461] Saudi Arabia does have labour laws but in a rather truculent about turn, the law does not extend to domestic migrant workers as they are seen to not produce goods or services that contribute to the economy.[462] Even if civil unrest became an option the logistics required to mount a demonstration would be insurmountable. Regardless of non-existent civil society to promote and encourage participation, migrant workers cannot travel freely or rely on a functioning public transport system to deploy demonstrators around the Kingdom on. With regard to oil, the vast majority of migrant workers are based in the Hijaz and Najd provinces servicing the high population centres of Mecca, Jeddah and Riyadh. The KSA security forces would not only be likely to suppress any demonstrations but also prevent the momentum from spreading to the eastern oil fields. A further intrinsic factor, mentioned earlier, is the need for the migrant worker to keep on working in order to send remittances home to their family.[463] However difficult their plight, migrant workers may feel that they would have too much to lose personally by attempting to influence Saudi society. After all it is no secret that affluent and politically correct Western ex-pats are aware of the Saudi's treatment of migrant workers but do or indeed can do little the alleviate their suffering.[464]

Civil society

Vlieger and Niblock point to a lack of civil society as to the reason why migrants cannot express themselves. Vlieger states that '[Saudi Arabia] does not allow for the development of civil society. As there is no freedom of expression, not enough people become aware of a problem to ignite collective action, and to the extent that there would be enough people, they do not enjoy the freedom to unite.'[465] Niblock adds that as migrant workers play no part in the Saudi political process it would be difficult for them to cohere together and become a politicised Saudi working class.[466] Niblock also argues that the same conditions prevent migrant workers from becoming religiously radicalised.[467] There has been much speculation regarding this issue

[461] Vlieger, Antoinette, *Ibid,* p. 161.
[462] Vlieger, Antoinette, *Ibid,* p. 174.
[463] Vlieger, Antoinette, *Ibid,* p. 172.
[464] A recurring theme recounted by Mackay, Sandra, *Op cit,* 2002.
[465] Vlieger, Antoinette, *Op cit,* p. 341.
[466] Niblock, Tim, *Ibid,* 2006, p. 55.
[467] Niblock, Tim, *Ibid,* 2006, p. 55.

migrant workers being a fertile ground for radicalization. The recruitment by terrorists of a migrant worker featured in the 2005 film *Syriana,* although there is currently little evidence to point to migrant workers turning to terrorism. As to how big a factor migrant workers play in Riyadh's decision not to develop civil society is speculation. But it would appear that Saudi society is willing to forfeit civil society in favour of retaining luxury and privilege at the expense of migrant workers.

Ex-pats reaction to 9/11

Prior to 9/11 Saudi Arabia was viewed by skilled Western 'white collar, middle class' ex-pats as a tax free high earning career move. 9/11 and the aftermath dramatically changed this view. At this time there were reportedly 30,000 UK ex-pats and 40,000 US ex-pats living in fortified compounds.[468] The wave of domestic Al-Qaeda terrorism that swept through Saudi Arabia from 2003-2007 claimed sixty three (mostly male) ex-pat casualties.[469] The deceased were employed by among others the Vinnell Corporation, Halliburton, BAE Systems and Marconi.

One infamous event that took place in June 2004 involved BBC journalist Frank Gardener who was shot six times while reporting in Riyadh. The incident received global publicity and left Gardener severely wounded.[470] A week later American Paul Johnson, a technician working for Lockheed Martin was kidnapped and later beheaded. The killing of Paul Johnson proved to be the trigger for an exodus of ex-pats. So many ex-pats left that the occupancy inside guarded compounds fell by 15%.[471] Western embassies advised ex-pats to leave Saudi Arabia to mixed responses. Ex-pats are under no illusion that Saudi Arabia has been a potential trouble spot for some time. However, as a career move Saudi offers a huge affluent market for cutting edge goods and services. Ex-pat roles offer responsibility and the opportunity to maintain and foster future contacts. Undoubtedly employers were keen to meet the obligation of safety and security of their employees but as is well understood, the psychology attached to 'staying in post' would also attract the promoting qualities of loyalty and resilience to any employee who endured.

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[468] http://www.theguardian.com/world/2004/jun/24/alqaida.saudiarabia
[469] http://en.wikipedia.org/wiki/List_of_militant_incidents_in_Saudi_Arabia
[470] http://news.bbc.co.uk/1/hi/uk/3781803.stm
[471] http://www.theguardian.com/world/2004/jun/24/alqaida.saudiarabia

For those ex-pats that chose to leave Saudi, Western companies attempted to rebalance the flow by increasing wages, relocating staff and extending holidays. Despite the expectation that the Saudi economy would suffer due to the reduction of skilled ex-pats a measurable decline failed to register. The combined action of Saudi and international intelligence and security forces almost brought Al-Qaeda operations to a close in the Kingdom. Although Saudi Arabia is still seen as a danger zone, business leaders called for extra security that the Saudi government was quick to provide. The extra security and a heightened awareness of the threat among ex-pats appear to have retained the vast majority of ex-pat employees.

Given that unlike domestic and manual migrant workers Western ex-pats were free to choose whether they left or not during this quite intense period of terrorist activity, aimed specifically at them, not enough ex-pats left to impact on the oil supply. Under the circumstances it may be that the 'critical mass' required to leave and create such an impact would occur only if residing ex-pats were expelled en masse by the Saudi government or collectively recalled simultaneously by every employer. The conditions surrounding such a decision would be extreme to the point of being fanciful in the least due to the perceivable damage it would do to the Saudi economy. Such a flight of ex-pats is therefore not just highly unlikely but inconceivable in the near and distant future.

Conclusion

Saudi Arabia's ex-pat community forfeit their potential to cause trouble for a number of conflicting reasons. Affluent ex-pats represent businesses that reward them financially and just as importantly in future career opportunities if they fulfil their roles, however dangerous. The businesses do have a certain amount of influence with the Saudi government regarding the treatment and lifestyle of their employees. Migrant workers on the other hand are a source of income to their individual families who have no influence concerning their welfare. The home government of a migrant worker has a greater interest in the overall economic gain received from providing migrant workers to the KSA and therefore accept and do little to prevent the ill treatment of ex-pat citizens as part of the process.

Domestic and manual migrant workers who make up the vast majority of the ex-pat community are denied the ability to generate long-term grievances. The Saudi right to deport sick and troublesome employees also removes cases where one individuals plight becomes a catalyst for mass protest. The key forfeit for all strata of ex-pat worker is the lack of civil society through which they can communicate. Whereas Saudi society could be regarded as being hierarchical and dysfunctional in its treatment towards ex-pat workers, the denial of civil society is universal. Around the vacuum of civil society the KSA has been able to construct a system whereby generations of ex-pat workers are attracted to working in the Kingdom for economic reasons, but hold few rights or means for redress while working there. The passive nature of the Saudi based ex-pat community is likely to endure until the oil revenues sink to a depth where Saudi businesses and citizens can no longer stay afloat with ex-pat workers still on board.

Executive Summary of the Second Prior Distribution

The second prior distribution consisted of six relevant risk factors, technology, terrorism, ex-pat workers, tanker design, the Strait of Hormuz and Saudi domestic instability that could potentially disrupt the Saudi oil supply chain. The dynamic capabilities of these factors are collectively wide and range in likelihood from ongoing, in the case of counterfeit Chinese oil field service products, to unlikely, in the case of a closure of the Strait of Hormuz. Nevertheless, between these two extremes there lie a number of important issues to address, for example, regarding the magnitude of potential disruptions, dispelling myths and approach to threat reduction which serve to highlight the broad scope of potential threats aimed at the oil supply chain.

Earlier detailed examination of each of the six risk factors has argued the contribution, if any, that each individual risk factor could pose. This final analysis will serve as an executive summary drawing together the ‘top end’ threats and offer suggestions as to the content of a third prior distribution.

The role of oil tankers featured heavily. The rather arcane world of shipping is often misinterpreted by Political science and International Relations scholars who stumble over the subject and overlook important technical data. The thesis raised questions

concerning the new double hull design and concluded that new build ships will probably react in a similar fashion to the older single hull design if targeted in a combat or terrorist operation. This transition differs from previous technical adaptations. After the Suez Crisis tankers were extended to carry larger payloads via the Cape of Good Hope which caused some tankers to explode during tank cleaning exercises. For this reason an investigation into the new double hull design had to take place, although after taking into account the result it is unlikely that this element would feature in any future prior distributions.

By far the most alarming disclosure went to Martin Stopford's scenario if the Strait of Hormuz were to close. Such an incident would be unique. Any foreign powers and stakeholders, whether that be importing states, aggressors, the oil and shipping industry, will have plans to avert the situation. However, there is no tried and tested method of bringing a closure to an end that would maintain the pervious status quo. How importing states would control the shipping industry to their advantage is another matter for concern, given that oil tankers are for the majority owned by private individuals or independent shipping companies.

The loss in revenue could pose a risk to the internal stability within the Kingdom, if the Saudi people were denied the benefits they usually expect from oil sales. A further, wider question mark could be placed over future large scale investment in Saudi and other Gulf oil fields by existing western technology providers if export cannot be guaranteed as has always been the case. A closure of the Strait of Hormuz however short in time would be a serious statement, in that however swift a resolution, doubt would remain as to how long traffic would flow before another closure.

The Gulf could once again face a huge environmental catastrophe from spilled oil. The shipping industry would not have the collective means to pay for a clear up operation so it would fall to the international community to bear this cost, and the cost of increased insurance rates. The consumer would also pay for increased shipping costs during the time that damaged ships were repaired or new vessels built, as a loss of tonnage would further tighten the shipping market. A closure of the Strait of Hormuz would be by far the largest disruption to the oil supply chain although the current likelihood is low. The event would require a mobilization of forces that would not go

unnoticed and would just as likely be resolved at a diplomatic level than the deployment and engagement of opposing forces in the Strait's.

One area of concern that raised an unanticipated paradox is the relationship between terrorism and counterfeit Chinese oil field service products. Saudi Arabia has invested a great deal towards the security of its oil wells and supporting installations in order to prevent an attack. However, counterfeit Chinese products have contributed to incidents that are just as damaging to the oil infrastructure as any planned terrorist attack could hope for. The fact that counterfeit products enter the market via an existing supply chain that appears to be relatively unchecked by Saudi Customs Agents has laid open an Achilles Heel in the Kingdom's Security apparatus. If results are anything to go by, Chinese exporters could be said to have almost done the terrorists job for them – rubber stamped by the Saudi Authorities.

The situation is further compounded by the fact that western technology will continue to prevail, as there are no other trusted brands to replace them. One unfortunate consequence for western manufacturers is that their products will continue to be targeted by Chinese counterfeiters, slowly eroding their good name. Western technology will endure, but unless the Saudi Authorities actively pursue counterfeiters, unnecessary accidents will continue in the field. Fortunately or unfortunately the severity of these incidents will not be high enough to disrupt the flow of oil for any significant length of time. This factor alone may hold the key to Saudi's passive approach towards quality control of imported products. Technology will certainly be an area to watch but can be removed from any future prior distribution, unless the situation changes significantly.

Terrorism had a greater impact on the skilled western ex-pat community than any other sector. Given the amount of casualties, criticism could be aimed at the Saudi Security Forces for not protecting western employees. This would be unfair. Western employers have been well aware of the facts and growing acts of terrorism. In many cases families were recalled but employees remained in post, supplying terrorists with potential targets. Employers and employees obviously felt the risk was justified in staying. Equally the Saudi government did not order its skilled ex-pat labour force to leave the Kingdom. One obvious reason is that skilled ex-pat employees could not be

replaced by Saudi nationals. This disequilibrium provided a constant stream of victims that frustrated the Security Services with constant criticism from the international community. Whether continuing generations of ex-pat employers and employees will choose to remain in post is unknown. Just as unknown is whether the same deaths will prompt the Saudi government to remain dependent on foreign ex-pat employees.

Non skilled and migrant workers were relatively untouched. In the case of construction workers, maids and domestic workers they are all but unseen in daily life and had no choice but to weather the storm. It would be easy to dismiss the role of ex-pat workers be it skilled or migrant workers from any future investigation. This would be a mistake as people are often the first barometer of change. So far the Saudi government has repressed any show of defiance but the fact that defiance is visible points to it being monitored. The effect of any possible threat to the oil supply chain should also be charted in relation to foreign and domestic nationals in Saudi Arabia. However, the overall impact of ex-pat workers could be subsumed into the panoptic challenge posed by instability within the Kingdom.

Underpinning the above is the stability of the Kingdom. The importance of oil cannot be understated. The Saudi Royal Family can only distribute revenues to pacify the Saudi people for as long as the King controls the Saudi oil industry. Therefore any challenge to the supply chain is a priority. The Saudi government can to varying degrees control technology, the safety of ex-pat employees and terrorism. Where the Saudi government has less influence is marine transportation and controlling the sea.

Regarding marine transportation, as an exporting state, Saudi relies on importing states to arrange and provide security for transportation; calculating that importers depend on oil and are prepared to place their own dependency on imports over the Saudi Royal Family's dependency on exporting oil in order to remain in power. Hypothetically speaking, if Saudi was unable to find a buyer for its oil the Kingdom would slowly disintegrate. However this is unlikely to happen for two reasons. Firstly there are enough importing states that have it in their own interest to import Saudi oil regardless of the revenues supporting the Royal Family. Secondly, the international community cannot afford to gamble that if the Saudi Royal Family were to lose power,

the replacement regime would be any more beneficial or cooperative that the current one.

The dependency theory encompasses the security of the Strait of Hormuz. Importing states are aware that a closure of the Straits would not only result in a shortage of oil to the market but also weaken the Saudi Royal Family as less revenue would be distributed among the Saudi people potentially causing unrest. Free moving marine traffic has not only provided constant revenue for the Kingdom but also payments which have sustained loyalty from the Saudi people to the Royal Family. It would be difficult if not impossible to separate the two and expect a functioning supply chain to remain. A further prior distribution would have to incorporate stability within the Kingdom in order to assess risk to the oil supply chain.

Of the six prior distribution risk factors two remain. Double hull tanker design and technology have been discounted. Of the remaining two the closure of the Strait of Hormuz can be labelled an orbiting threat to the Saudi oil supply chain. The second remaining risk factor, Saudi instability has absorbed terrorism and ex-pat workers into its universal canon of potential threats. Both of these issues pose a latent threat to the supply chain, but as previously mentioned the geopolitics of oil are rarely static. The future will no doubt introduce new as yet unknown threats. Even if these threats are identified they cannot be fully understood until their impact is analysed in relation to possibly disrupting the Saudi oil supply chain.

Research for this thesis was undertaken before the momentous events in Syria and the rise of the Islamic State movement. These two events have reignited the complexities surrounding the Sunni/Shia divide. A future prior distribution would benefit from closer analysis of this situation and could extend to the reintroduction of boundary disputes. One of the primary strengths of Bayes theory is that factors can be discounted and then reintroduced if they resurface during the movement of time.

Chapter 7

Conclusion

The risk assessment of the Saudi Arabian oil supply chain has been analysed and explained. The Bayesian risk assessment reduced, implied and perceived risks down to a list of six threats namely technology, terrorism, ex-pat workers, tanker design, Strait of Hormuz and Saudi domestic instability that could realistically disrupt the Saudi oil supply chain. At first glance it would appear that the KSA oil supply chain has maintained its resilience as it did when faced with previous historic threats. 2001-2010 was an extraordinary decade. The passing of 9/11 2001 and subsequent focus on wider Middle East security provides an appropriate platform to discuss the KSA oil supply chain's strengths, weaknesses and future survival.

The immediate aftermath of 9/11 poured fear along the KSA oil supply chain. However, the physical infrastructure incurred only minor damage that reduced production. This was due to the high quality of service provided by predominantly US and European engineering, maintenance and technical crews. Positions in these support services are still however viewed by potential Saudi workers as unattractive careers to follow. Previous incidents along the KSA oil infrastructure have been reserved for accidents. This did not prevent several misplaced think tank scenarios' involving terrorism aimed at the oil infrastructure generating implied risk for political ends. The supply chain can be said to have been a political tool for such purposes during this period.

The oil infrastructure is difficult to damage effectively but the targeting of western ex-pat workers was not. The actions of threatened KSA based western personnel were quite striking. Ex-pats often ignored advice to leave and chose to remain in post. Employers had the advantage of offering financial incentives to employees based in the KSA. This and the kudos they would gain if they stayed behind became factors in the ex-pats' own contradictive risk assessment. Fear that Saudi would import terrorism via its ex-pat domestic workers failed to materialise. Any extremism tended to be exported. It cannot be denied that the Saudi security forces reduced the incidences of terrorist attacks on the oil infrastructure and ex-pat workers, thus preventing a potentially disastrous exodus of key professionals from the Kingdom.

Probably the most serious random damage that challenged production came from China. The rise of China on the world scene carried counterfeit parts into the oil field service industry. The War on Terror appeared to be quite accepting of seemingly legitimate Chinese parts and machinery that have the potential to cause successive disruptions. The impact of counterfeit Chinese products into the oil field supply inventory accentuates the concern held by many established manufacturers that the Saudi government is not initiating enough customs control procedures to prevent counterfeit items entering the supply chain. Admittedly, some technical data was simply not available due to it being commercially sensitive. However, oil field service personnel were curious and enthusiastic about academic research being conducted in their area of expertise. Recent unpublicised incidents in the KSA oil fields may have eased their willingness to discuss this subject.

If custom checks and quality control procedures do not improve then the continued acceptance of counterfeit parts will over time damage the reputation of established providers. This in turn could remove some manufacturers completely from the market. Counterfeit products will continue to cause catastrophic failures in the field of a magnitude and precision that terrorists could only dream of.

The land based risks were relatively simple to evaluate when compared to the complexities of the risks facing oil tankers. KSA oil exports depend on a regular flow of oil tankers to distribute crude. Previous activity during the 1988 tanker war that had targeted oil tankers in the Gulf required updating. The tanker war involved military action that had destroyed or damaged single hull tankers. The new upgraded double hull tankers are a relatively unknown combat entity and therefore required further analysis.

The resulting study, although never entirely conclusive is favourable. If hit by a missile double hull tankers can be expected to react in a similar fashion to single hull tankers. However, the intricate double hull design may cost more to repair. The comparison was not wasted. A similar estimate is missing from current literature. The primary risk for oil tankers servicing the KSA oil supply chain involves transiting the Strait of Hormuz. Modern double hull tankers are more expensive to insure. A growing legacy of the Iraq war are private security companies. Private security companies aim to

provide an armed escort to offset insurance risks incurred by tankers transiting the Strait during a crisis. Just how deep these new private armies will penetrate the shipping industry remains to be seen.

Iran has constantly threatened to close the Strait of Hormuz. Although the thesis did not set out to explain precisely how, why and when Tehran may choose this option, some examples were offered. Previously during the Iran-Iraq war Tehran did not execute its threats. Regardless, it became apparent that scholars were both confident and keen to point out that any closure of the Strait of Hormuz would be dealt with swiftly and the Strait reopened to traffic shortly afterwards. This theory may well prove to be true, although little or no attention is played to the collateral risk such a closure would pose to the tanker shipping industry. In as much as Tehran has not realistically attempted to close the Strait, the threat still remains live.

Of greater value in the thesis is the analysis of how the oil tanker industry would react to a closure of the Strait. Martin Stopford exclaimed that he had never made his thoughts on the question of a closure of the Strait of Hormuz public before. Stopford further confided that such questions came before him in nightmares and are simply not discussed openly within the shipping industry. Clearing the blockage may be swift and victorious but a pyrrhic victory when set against the stigma a closure could cause. Stopford indicated that a closure of the Strait may result in the United Nations nationalising shipping. He then remarked that some oil tankers are so big they cannot load oil anywhere else but inside the Gulf, rendering them useless during a closure.

The evaluation Stopford gave in this thesis is again significantly missing from current literature. Given the importance of understanding the damage a potential threat can cause, the omission of any explanation regarding a closure of the Strait of Hormuz is one current political scientists successfully omit from their theories. Would, for example, a closure of the Strait be a watershed moment? The Strait would no longer be a dependable waterway that had never closed before. Instead the Strait could not be fully relied upon. A future study would not be out of place to determine whether a closure would realistically result in a long-term loss of confidence in Saudi oil and if so how the loss of confidence would affect large scale investment, research and development in KSA oil field operations.

The area where the land and sea based KSA oil supply chain combine is maintaining Saudi internal stability. The importance of Saudi oil exports contributing to Saudi economic stability cannot be overstated. The Saudi Royal Family control business in the kingdom. They utilise revenue from the international sale of oil to improve the lifestyles of their subjects and in doing so make the Saudi people dependent on regular welfare payments. This dependency has caused concern among Saudi's allies, particularly the state sponsorship of religious education among young Saudi men. The teachings invariably transmit fundamentalism which is further encouraged by the somewhat self-serving influence from the US.

So far, the Royal family has managed this delicate balance with regular oil sales. If the Saudi government is prevented from exporting oil this could lead to a weakening respect towards the King and turn instead towards other systems of rule. Between 2001-2010 Political thought rarely had time to establish itself before further change swept it aside. Throughout this often-violent period Saudi Arabia exported oil. The resilience of the supply chain infrastructure and surety of exports maintained stability for the King's subjects.

Any future energy policy which aims to vastly reduce the market share of Saudi oil should also consider who or what could fill the void. Maintaining revenue via international oil exports may well be propping up the problematic Kingdom, but any policy that aims to interfere with the status quo may have to accept that not only could the Saudi Royal Family collapse on top of it but from the dust may emerge a regime that attracts the wrong sort of attention from the international community. A community who may then choose to neutralize it and re-install the monarchy on the proviso that the liberators run the Kingdom's oil industry.

Far from being fantastical the above is a policy that US President Richard Nixon first mooted in 1973. The spectre of regime change has run parallel with Saudi oil production for over 40 years. To date, the spectre's policies have allowed the monarchy to keep one step ahead. When the resilience of the KSA oil supply chain is considered, the Royal Family will continue to rule, and by default invest heavily in the Kingdom's decisive oil supply chain.

APPENDICES

INTERVIEWEE 'A'

Transcription of Interviewee 'A' 18/11/2008

Duration of Interview: 00:13:44

[Beginning of File]

Good morning, could you please introduce yourself.

My name is A, and I'm the regional manager for AA, a small SME based in Scotland.

Could you tell me please what product you market?

We market a suite of down the hole service products that go into the oil wells.

Is there an intellectual property right issue with those?

Yes, yes there is.

Where does the expertise in your product lie?

The expertise in our product lies within the design, the design and the operability of the product in the well.

Does it also rely on the quality of the materials that make the product?

Yes definitely.

The raw materials?

Most definitely, yes.

Could I ask roughly what percentage of your business is in Saudi Arabia?

Oh gosh, in Saudi itself there's probably only about ten percent of our business just now, but we're planning to grow that over a number of years ahead of us.

Are you aware of any copies of your product being made?

Not to date. Not to date.

Do you think that Chinese manufacturers can produce the right grade of steel to manufacture a product at a competitive price at the moment?

At the moment I don't believe so, no.

Do you think that may change in the future?

I think so, I think with proper quality controls and measures put in place, the potential is for them to do that, yes.

Do you think it would help their quality control, the Chinese quality control if they were to work side-by-side with large European and American manufacturers?

Yes I believe it would, yes.

Do the Chinese respect, in your opinion, do the Chinese respect intellectual property right, copyright?

No. Definitely not.

Do you have any particular reason why that is so?

Well they're certainly world renowned for taking products and copying them and putting them back out to market.

Do you consider that to be a cultural issue within China or something that they are using it to their advantage to gain more market share? Is the government turning a blind eye to it in your opinion, the Chinese government?

I believe they are, I believe the Chinese government are turning a blind eye to it, yes.

So something that would aid your own, the furthering of your own company and its product would be a tidying of regulations regarding copyright?

Most definitely, yes.

Would you ever sell any of your equipment directly to the Chinese?

No.

So will you go into partnership with a Chinese company?

Possibly, but not right now.

Are you keeping, are you monitoring how other companies who have gone into partnership with Chinese are performing?

Well we're certainly keeping an eye on it, yes.

To your knowledge are some people having mixed experiences or?

I believe so, yeah, I think there's been a number of manufacturers gone into China, some have landed lucky, done well, but others have not been so fortunate.

Is there any particular previous case or case study that you can think of that sums up your own thoughts on doing business with China?

Well there's been a couple of incidences, one in particular was back in 1997 where I was working for a large well head company and we had several blow-outs in the Saudi

Arabian marketplace that caused field fires and subsequently the Red Adair crew had to come in and assist by putting the fires out. The investigation took place and found out that there was non-OEM, original equipment manufactured products and seal equipment or components were being used in those blow-out preventers. Subsequently the investigation found that those products were being bought from China.

What would, in your opinion, have been the difference in cost between buying a copy and buying the real thing?

I couldn't possibly put an actual figure on it, but I think it may well have been about fifty percent dearer.

And the actual cost of the blow-out, of the disruption to production?

Well several millions. Several millions.

And within the oil industry is such a stoppage or such a blow-out or accident, is it every equated to a similar disruption that could have been caused say by a terrorist or is it classed as something that happens within the manufacturing process, the production process? It causes the same disruption but by a different …

By different means, yes, yes.

Is that viewed differently, is it a production risk involved with the production of oil?

Yeah it is, it's viewed differently, but I think the oil companies have to stand, to take a stand of what they're buying and make sure that they're buying quality products because as a prime example of buying cheap put a lot of lives at risk.

Do you think you will be able to survive without involving yourself with the Chinese market?

Yes I think we could, yes.

Is there any particular reason for that?

We're well established in the marketplace, we've got a good quality product and the performance of the product speaks for itself, and there's no particular need I think at this stage to go into manufacture in the Chinese market unless we get into mass production.

Do you think that one of the strengths of your company is that you have longstanding ties and relationships with customers in Saudi Arabia?

I think so, yes, yes.

And that's nothing that the Chinese …

Well I think the other factor you've got to take into consideration is the oil and gas industry was traditionally set up in the west, America and North Sea were leaders of technology, we're always advancing our technology, we're thinking out of the box and better ways of working, and unfortunately there's other areas of the world are taking our lead. Unfortunately, China had decided to just take our products and copy it rather than …

Do you equate by any way not involving China, but did this rise in their interest in the market share happen after nine-eleven?

Pretty much yeah, I would have to say yes, they've always been an oil and gas producer but not in a sort of global scale that a lot of areas are.

But they had room after nine-eleven?

To do that yes.

And do you think that if you decided to take an isolationist's stance where you decided that you wanted nothing to do with China, given that China are involved in the international oil industry …

Yeah.

… is an isolationist's policy towards China wise?

I don't think completely, no, I think they will become a bigger player in the oil and gas market and we may at some stage have to embrace them as part of our space.

Do you think it may be beneficial in the long run if Chinese manufacturers worked with large, like Schlumberger, Halliburton and whether large companies who have the margins would be able to accommodate the training of Chinese managers?

Yeah.

Do you think that would be to everybody's benefit to eventually …

Absolutely. Absolutely, they've got a certain – the Blue Chip service companies have a bit of surplus if you like to assist with the growth and education of the Chinese market.

It's been put to me at the exhibition that if a product could be made in China cheaper than it could be made in the UK that's acceptable to do so, what do you think the UK will lose if this expertise is taken out of the UK?

We're going to lose a lot of business, we've got some specialist engineering services in the UK that supply the global oil and gas marketplace and I think it would be detrimental to the UK business if it was, if certain aspects were to be taken out of the UK.

And there is within the press a lot of resentment towards Saudi Arabia, having worked here yourself, do you feel that there is conflicts between people who work in the oil industry and the general population within Saudi Arabia?

This is a difficult one, I don't think so no, no the Saudi population are pretty much open to learning, to understanding oil and gas, they're very much open to taking on new technology, so I don't think there's a resentment there.

Do you think it might have been more beneficial if the factories were actually built in Saudi Arabia to be used by, to be staffed by China and the States rather than moving into China, do you think there's a need to bring the Saudi nationals into the oil industry in a larger, greater way than they are at the moment?

From a manufacturing perspective I don't believe so, no.

You would prefer to work with the expertise where it's traditionally come from?

Yes, yes.

How many Jewish people do you know who work in Saudi Arabia on the oil industry?

None, I don't believe I know any.

But there is a great Jewish, there is a great Israeli lobby that influences the press in the States, there is a right wing press which influences, do you notice in Saudi Arabia any of the conflict between Israel and Palestine spilling out over into your work here?

No.

It doesn't affect it?

It doesn't affect it at all, no.

But you don't find at the coalface as it were …

No.

… that you're working face-to-face with or you're working alongside people who are Jewish?

If there were Jewish there, there's mixed nationalities we work with and we all work in harmony with the oil and gas industry and we're all in the same boat, we're working with Saudis, Filipinos, Pakistanis, Indians, Brits, Americans and we all work very well together, so.

Okay and at the moment if I was to sum up I would say that you're prepared to work with the Chinese when their standards are at the same level as your own?

Yes.

And one of the ways for them to reach that is to work alongside or under the sort of – with a large American company shepherding them?

Not necessarily American, but certainly a larger organisation that has high standards of quality, yes, yeah, shepherd them along.

Okay and your own company doesn't have that ability, doesn't have that margin?

No.

Financial sort of margin to do that?

No, not at all.

So in many ways now you're reliant on the standards that they adopt from the partner of large companies?

Larger companies, yes.

To move forward and are you confident that the standards will remain as high as they are and that they won't drop to accommodate Chinese malpractice?

There's always a risk of that. There's always a risk of that happening and I would hope they wouldn't drop because it's putting a lot of people's lives at risk if they were to drop because we've learned, we've been very fortunate in the oil and gas industry, we've learned over decades of time that what's good and what's not and we've learned through our experiences, I don't have to mention Piper Alpha some years back, ten years back, we're still learning from those experiences, and unfortunately there are other oil and gas areas in the world haven't had that experience in oil and gas to learn from it.

If I was to look at the amount of work and investment that's going on in Saudi Arabia and oil at the moment, would I be misconceived to say that there is so much technology and there's so much investment in new technology that it's because the fields are actually depleting and that there is more technology needed to get remaining oil out more economically?

Yeah, there's a part of that, yes, some of the larger fields have been around for a long time so increasing technology to get it out a lot cheaper, but there's new fields coming on stream and they want to apply the high end technology to maximise the efficiency of that field.

Well I think that's just about it, actually, thanks.

I appreciate that, David.

That's the lot, I can thank you.

Thank you very much.

[End of File – 00:13:44]

INTERVIEWEE 'B'

Transcription of Interviewee 'B' 18/11/2008

Duration of Interview: 00:16:37

[Beginning of File]

Thank you for offering to give me this interview. If I could ask you please what product do you market?

We market several products that are sub-sea and surface intervention systems. We started with our core product of a well tractor which conveys logging tools and coil tubing out into high angle and horizontal wells. I mentioned sub-sea because that's a new focus for us, and we're trying to become a sub-sea intervention specialist.

So off-shore work?

Yeah.

Are there intellectual property right issues with your products?

Yes there are, we have at this show a company that has been a fast follower and you could almost say a copycat of the technology, we have a couple of other companies that have tried to enter this business and which we had at least a three to four year head start in and so I would say that the technology has caught on, it's becoming mainstream as far as the conveyance, but when it comes to the mechanical intervention services it's brand new, we're still taking the lead on that but again there's some fast followers.

Can I ask you then where does the expertise in your product lie?

It's in the quality and the design of the technology as these are electro-hydraulic devices, the tolerances are extremely high they're in the order of a couple of microns

of moving parts. We have several metal to metal seals because elastomer seals create too much friction and make the equipment less efficient. And well you think that we have a best in class technology of this kind and that's why we're the market leader.

So what percent of your business is actually in Saudi Arabia?

A very small percent, we're just getting started in Saudi, we've actually had people here on the ground for, I'm going to ask my colleague, here is it, have you and Mohammed been here even a year?

Colleague: One year, yeah.

One year? Okay, so we've had some people on the ground for one year and we're looking for opportunity to set up a base of operations.

How much R and D went into this particular product?

Well it took a couple of years of a Master's thesis from the founder, Jorgen Hollenbeck, he came up with the concept of tractoring and it was initially a coil tubing tractor to be able to extend the reach of what coil tubing can do in high angle wells. But the, I forgot the question?

I said what percentage of business is in Saudi Arabia and then I said …

About the technology what was the next question?

Yeah I said [pause] the R and D, how much R and D went into it?

Sorry, Wow I spaced out, so how much R and D, I'd say in the initial product of the well tractor there's a few years of R and D that went into the electric motor that's a patented device, the hydraulic pump with its two systems, the compensation system, the wheel drives which are little hydraulic motors, very small miniature hydraulic

motors in each wheel. There's quite a bit of R and D that went into that and there's continuous R and D going into all the mechanical services that we're doing now.

Are you aware of any copies being made of your product?

Not exact copies since the tractor, the tractor has been copied, we've had a couple of lawsuits about it, there was some friendly courts that allowed a lawsuit to – there was some payment, they were allowed to continue under certain conditions using the copycat technology and that's what's sitting across the way.

Was that in a western court or was that anywhere else?

It was in a western court, it was in the home country court of the copycat, it was a favourable decision for that copycat. Is it good to call it a copycat?

Yeah that's fine.

Alright.

To your knowledge, are the Chinese able to produce the grade of materials and machining to make your product?

I'm sure they could eventually but I think it would take them several years to get all the processes down to get the tolerances so that it would be as efficient and create the power and speed that these tools can deliver right now, I don't think they could do that in the timeframe that they're used to copying technology.

Do you think that the Chinese will continue to ignore copyright?

Yes I believe that they have an official policy of technology transfer that's what I was told when I was there that they want to take western technology and bring it in the country and that's why they do not have laws against taking and stealing copyright and patents.

And does the state turn a blind eye to that or even encourage it in your opinion?

They encourage it, it's may – that's in my opinion because just the conversations I had with the people in the industry there, it seems it's not just a blind eye, it seems like they encourage technology transfer in this manner.

There are literally hundreds of thousands of graduates coming out of European and American universities who have done engineering degrees, at that level do you think that there was enough emphasis put on regulation within the engineering industry so that recent graduates, recent Chinese graduates would go back to China with an understanding that regulation was important?

I think they realise that but if they're going to go and get a job back in their home country and then, which is what they all want, and that company has a practice of doing technology transfer as we were calling it, then they will continue that, even though they might know that it's wrong by western standards, they know that it's acceptable in their culture.

Do you think if Chinese manufacturers work hand-in-hand with very large US and European concerns do you think eventually they will have to embrace the regulation, the regulatory power of copyright and also of ISO standards?

I think the western Europeans, the North Americans, the countries, even Brazil now, has quite a few new technologies and they are interacting more and more with the Chinese, they have to insist, I think it's, I don't think it's going to be a government solution, I think it has to be, well it probably has to be at all levels, but certainly the corporations have to insist that there is equal, mutual protection for the IP, their technology's going to be protected. Eventually China is going to come up with some of their own stuff and they're going to want that protected.

Would you sell your product directly to the Chinese?

No, we have no intentions of selling any of our technology to the Chinese.

Would you in any way go into a partnership with a Chinese company?

Yes, but it would only be under very strict controlled conditions and we've already discussed how that might work, but we have a lot of anxiety about that.

Do you think in the long-term you will be able to survive without involving yourself with the Chinese and the Chinese sort of market?

Yes we're growing quite quickly, we haven't even dented our potential, we think we're at about point two percent of the potential market for what we're doing, so it'll be several years before we get to the point where we feel we have to have Chinese business to grow any more. We are looking at China, it's just it doesn't appear to be right, the right climate for us to go in there at this time.

Do you think in the future it will be possible to survive if you take in isolation this stance towards China completely?

Well again I'd say we probably have five to ten years of just good organic growth in the current industry, the non-Chinese industry to reach our potential and I would, at some point in the next two to three years we will probably start getting serious about working in China, and that means we will have a very good trusted partner to work with from there.

Would I be right in thinking at the moment the risk in joining China in the market is in the fact that you cannot rely on their product and you cannot rely on their quality and they are also open to copying your product and marketing it themselves?

That's probably an accurate statement, because the latter part of your statement is the biggest concern to us is that we will find our equipment disappear for a while and then it'll maybe even show back up, but there will be copycats all over.

From your own experience within the oil industry, can you think of any case studies that have emphasised China's, the negative aspects of China being involved in copying parts of equipment that have failed in the field?

That have failed in?
In the field.

Of their?

Or have been passed off as originals that have failed in the field?

Not in the oil industry, I know that they've done some copying of some of Schlumberger's technology and I know that they've been working with a couple of western companies out of Houston making some copies of other companies' technology, not just Schlumberger, so I know that they – but I'm not aware of failures, any like higher failure rates. All technology is less than perfect if it's, the higher the technology, the more problems that can happen. So I just don't have any statistics to make a comment on that.

Would you class the company that you work for as a large, medium or small company?

Service company, a small service company.

And [pause] which area of manufacturing would you say would be most at risk, would it be high volume, small products that are easier to clone or would it be expensive one-off products that you can really cut down the margin if you skimp on the quality and?

It's my impression that the low technology, high volume product manufacturing would be at risk, I don't see the one-offs and the very large items being something that would be a serious threat at this point of time in this industry.

Colleague: Sorry, can I have a business ref?

Yeah. Here's a couple more just in case.

Yeah. Last question to ask, it's been put to me that if a product can be made in China cheaper than it can be made in western European or an American country, that is acceptable, if that's the case, eventually what do you think that European and American manufacturers will lose to the Chinese?

Well I'd say that we have no intention, our company, if you're talking about our company Welltech or in general?

In general, I'm taking a case study from the Japanese car industry which sold very poor quality cars and then all of a sudden moved its quality controller and people started to buy Japanese cars on a large scale and of course England lost its car industry …

Yeah, so could that happen in China?

… I'm seeing whether, whether China with its - not only the product but the technology and the manpower eventually.

Right, 'cause they can do things so much …

So much cheaper.

… less expensive and so that is possible, they have several years to go in terms of the oil industry getting their technology, being able to manufacture and have all the skills that have taken years for some of these companies, these western companies to develop the knowledge and I don't think they'll be able to do that in the short-term. But I'm not surprised if they start making inroads into that area.

I get the impression from looking at the kit that you've got here, you don't manufacture rubbish, as somebody who has been in the oil industry for the

length of time that you have, how do you see the Chinese, do you resent the fact that they're taking the approach that they to this market?

No I don't, I honestly don't blame them for the way they've been operating up till now, but I think it is time that they joined the rest of the world in supporting the patent laws, copyright laws and all the protections for people's technology 'cause I think they're going to, if they don't, they're going to have a more and more difficult time at becoming partners, nobody will trust them. So I think it's time that they changed their business model.

Is that something that could be done at state level, do you think that …

Oh yes, I …

… diplomats could be doing a lot more in China to get the point across that it's the quality and the goods that they're exporting that needs to be checked?

Well yeah certainly it's, but you mean the diplomats from the western countries?

Yeah.

Yes but I think you would think that they would realise this, the handwriting's on the wall, they have to change, they have to start having protection for this if they want to be an equal partner because otherwise they're always going to be considered one of these outsiders that you can't trust and so I would like to think they're intelligent enough and that they'll do it on their own but maybe not, maybe they see that they've been successful so far why change?

Do you not think though that producer states who import crates of equipment that they were once importing from Scotland with the same mark are now importing it from China, it looks the same but they know it's a copy?

So what's the question?

Well do you think that producer states could do more as well to regulate the quality of product that's coming into the, if it is a copy?

Could they do more to regulate the?

The amount that's being imported?

Yeah, I think yes I think some of the governments have been turning a blind eye to some of the cheap imitation copies of things that have come in, I think there could be a lot more done there.

Okay, that's all, thank you very much.

Okay, you're welcome.

[End of File – 00:16:37]

INTERVIEWEE 'C'

Transcription of Interviewee 'C' 18/11/2008

Duration of Interview: 00:28:23

[Beginning of File]

Thank you very much for giving me the chance to interview you on these set of questions.

You're welcome.

Could I ask what product do you market?

We sell software for the upstream oil and gas industry and that software helps companies be more efficient and more productive in producing, finding and producing oil.

Is there an issue of intellectual property rights?

Of course, with software there's always intellectual property rights that you're concerned about protecting, you're always have, think you have a unique and patentable IP, and in the United States obviously for us that's a big concern.

Where does the actual expertise in your product lie?

The expertise lies in that the software we have is very focused on specific operational and intelligence issues within oil and gas companies, so that's where some of it lies and then also in our expertise of many years of providing services and software to specifically to the upstream industry.

How much percentage of the business is research and development?

I would say probably thirty to forty percent of our business is research and development.

Are you a large, medium or small manufacturer?

We're a small company.

What percentage of your business is here in Saudi?

At the moment it's a small percentage of our business, but over the next couple of years it should become up to twenty percent of our business.

Are you aware of any copies of your product being made?

You mean illegal copies or?

Just turning up in the market or anywhere.

At the moment some of our software is not unique in what it does, but the software that's interesting to Saudi Arabia is unique and we don't see any copies of it yet.

Do you think that the Chinese have the capability to produce your product at a competitive price?

I would say that the nature of software is if you continuously develop your software, any company has the capability or any country has the capability of reproducing what you do, but they'll always be behind you. And if they're only copying what you do, they'll never exceed what your product so. So yes, they have the capability of reproducing it, but they'll always be a year or two behind us because we're always innovative and they're just trying to catch up.

Do you consider that the Chinese manufacturers in general are making copies of western oil field equipment?

Yes, me personally I believe there are companies, I'm not sure if there is any stance one way or the other, but we are concerned about the Chinese actually trying to replicate our intellectual property. So yes I believe that they can.

Do you think that the Chinese will continue to ignore copyright?

Yes there's no reason, there's nothing that I know of that would keep us from believing that.

Would you go into partnership with a Chinese company?

Would we? [Pause] I think it would be considered under certain circumstances, yes.

Do you think the Chinese will benefit regarding their regulation of copyright by working side-by-side with some of the larger engineering concerns?

I don't know, that's an interesting question whether they would benefit or not. Once again, you can't make a judgement about an entire people across the board, so some companies or some individuals within China may benefit from that, but as a country it's an unknown to me. I don't think so, but I don't know.

If American firms heavily invest in China and regulate the quality of their own products leaving Chinese factories, do you think that may have an impact on Chinese manufacturers?

Well it certainly could because then there's the chance that just through association they would learn new techniques and be able to do a better job and quality would improve and perspectives would improve, so it's possible.

Will you be able to, will companies of your size do you think be able to survive without involving yourself in the Chinese markets in the future?

Yes I think we could survive without having anything to do with the Chinese market.

Do you think that goes for people who are actually making components for the oil and gas industry that could be easily …

That's a great question 'cause obviously there's a tremendous amount of potential for manufacturing out of China at lower costs and such so they could probably survive, would they be more efficient or make more money? Could be.

Let's say I have a product which relies on intellectual property rights and also the quality of the grade of raw materials that go into that product and I take an isolation stance from China, do you think I can survive?

I think that a company can survive in the short-term, in the long-term, you're talking, with the isolation that's thought right off at the beginning that obviously is going to be a problem because more people could take advantage of the fact that you're not using the Chinese but there's the issue of is my IP protected?

I have often been quoted as I've walked down the different stands that the same situation happened with Japanese cars, do you think that any of the lessons learnt from that and the loss of manufacturing base after the Japanese took over can be saved this time round?

Well you would certainly hope so, you would hope that we would be able to learn from those lessons. I think the real lessons with the Japanese were that we didn't take them seriously in their ability to produce a quality product and so for years and years we ignored it, and if the same thing were to happen in China, I don't believe that we would ignore it nearly as long or I think we would take it more seriously.

Do you think that China lacks in research and development?

No I think they probably do …

[Long announcement]

Okay, lessons learnt from Japan and R and D.

Yeah, right so for the Chinese are they? Okay, so I believe the Chinese actually are very capable of R and D and are spending time and effort on it, now it may be misdirected, so maybe R and D need to try and replicate someone else's products rather than going off in their own direction, but the evidence is they're trying to do space exploration, they're trying to do satellites, and you can't, that's not indications of trying to replicate someone else's product but trying to actually be innovative, using other people's research possibly, which is, we would do the same thing, but they are trying to be innovative. So they are actually spending time and effort I believe in doing those things.

With so many Chinese students attends European and American universities, do you think it would be beneficial particularly in engineering and technology based degrees to increase the amount of emphasis on the need for regulation in those degrees?

Well it certainly would be beneficial I believe in the long run, yeah.

But there again do you think that the decision to adopt this sort of transfer of knowledge is something that's coming from the state rather than from the will of the people involved?

Yeah.

Is the Chinese government turning a blind eye to it?

Yes, I believe the Chinese government should think about regulating it a lot more with the transfer of knowledge and the students as you said in Europe and other, outside of China, they're certainly going to see the importance of regulation but is regulation necessary? More regulation necessary? Absolutely, and more self-policing by the Chinese government.

Do you think that the western embassies in China could do more to put pressure on the Chinese government to regulate their copyright with intellectual property issues?

Could they do more? Absolutely.

With that change being at a more ministerial level?

Absolutely, yeah, there has to be in any country that should and wants to respect other countries' intellectual property it has to come from the top to make sure that everyone understands this is what we will do as a nation, yes.

A producer state like Saudi Arabia, if it imports crates of equipment which is coming from China but which is marked up as being a western brand, do you think the producer states could do more to filter out any counterfeit equipment?

I don't know that they're not necessarily doing what they should be doing, but if that's the case then I think it's the responsibility of the producing states to actually try to make sure that the organisation that claims to be making it is actually making the product and that the dollars that are being spent actually go to the people who actually, who own the intellectual property and producing it. So they do have a responsibility to do that.

Do you have any particular case study that you've heard on within your industry either positive or negative about Chinese, about doing business with China? Any anecdotes or?

Yeah, not case studies but anecdotal stories where in meetings we've had, well there have been people that I've been associated with that have been in meetings, that were very, very careful about disclosing any kind of intellectual property in any way just because of the fact that the reputation has been and practical experience has shown if you leave something with the Chinese, six months later there'll appear a copy of it, and so there have been stories about that.

So how would you sum up the threat that China poses to US and European technology at the moment?

Well, at the moment it's a mild threat to a medium threat meaning there is concern in doing business directly with China, introducing anything that you want to protect into China it's presumed that it will be copied in a relatively short period of time using reverse engineering techniques, and so that's, to any company that wants to do business directly in China that's a concern. Outside of China where Chinese organisations exist that becomes a mild threat that if you leave anything with them that can be copied the thought is they will attempt to do that, send it back home and have it, have that intellectual property copied or mistakenly taken.

Okay, if I could change the focus of the interview now over to the Arab/Israeli conflict, can you see any way that the Arab/Israeli conflict affects oil production in Saudi Arabia with European and US technology and ex-pats?

Can I see any way that it's affected? I think that number one, since no person of Jewish background is allowed into the Kingdom to begin with, that number one impacts your ability to have the most efficient, most productive methods available. It's not necessarily that the Israeli people as a whole are that much smarter, but if you reduce the knowledge base available in any industry then you're cutting yourself off, so that's number one, you're reducing the possible knowledge base. But the fact that the dislike each other so much probably has a lot to do with what drives certain individuals within the Kingdom, not necessarily from the top, but there's going to be this distrust and this constant conflict and so not being able to bring in your most, from Europe and the States, not being able to bring in your most productive, your most intelligent people and all of that because they're of a particular race can have an impact. Now for me personally I know individuals that are Jewish and that are not able to do business here in the Kingdom and that is, that doesn't necessarily hurt me personally but it does slow down sometimes my capabilities in performing all of the duties that maybe need to be performed.

Do you think that the media in the States particularly the right wing media which is often funded by very pro-Israeli groups is particularly accurate in its portrayal of the policies in Saudi Arabia towards the rest of the world regarding oil?

That's a good question, I don't necessarily know that what your original premise that it's all funded by Jewish, you know, right wing …

Heritage Foundation for example.

… yeah, I don't, I personally don't necessarily know that that's true, obviously you have more research, but Heritage Foundation absolutely. But the media itself tends to have a very negative view of what happens in Saudi Arabia and oil and just the Middle East in general. If I had not been in the oil industry for so long and all I took was what the media produced specifically on the conservative right wing side of the house then I would believe that probably one hundred and eighty degrees of what actually happens in the oil industry in the Middle East obviously the Middle East is the Arab/Muslim culture has a tremendous impact on what happens in the Middle East, they own a lot of the oil, everything that we need in the United States for oil production is extremely dependent on this area, but yet the view is they're backwards, they're unintelligent that they're mean and nasty and they hate us and all of those things from the media perspective, and so yes that's obviously impacted by the Jewish perspective.

Is it, to your knowledge, are there any Jewish CEOs in any of the larger major oil companies?

Not to my knowledge.

Is it an industry which is dominated by the will of the producer states or the ethics of the producer states because there is quite a disparity within American culture that people, Israelis or Jewish people cannot involve themselves on the hands-on, coalface side of the oil industry, or given the amount of money there is involved, finance, they can't involve themselves on a boardroom level of the decisions.

That's an interesting question [pause] yeah I don't know, it certainly has an impact and once again back to what I was saying, if you give, if you completely eliminate one segment of your intellectual pool because they're of a certain background that's not good. But in the States for all that I really can talk about from a long history, there are Jewish, there's Jewish involvement from individuals, right, there's a lot of Jewish people do like the oil industry, are they impacted as far as promotion and ability to have strong position within these organisations? Probably because the producing states say, number one, you're not going to get field experience, you're not going to be able to be here, but there is a lot of experience that actually occurs outside of the Middle Eastern states, a lot in Latin America, Central America, North America, tremendous amount of experience that a lot of the Jews as a whole can have experience with.

To your knowledge have the Jews in America ever become politically active in that area, have they ever had a demonstration, have they ever caused any unrest because they can't get involved in what is the world's largest global industry?

Yeah, to my knowledge no.

I mean that in itself seems to contradict many people's feelings towards …

Sure does, yeah. Yeah it is kind – you would think that if it were such a big deal that they would protest about. Now, I don't know that I can really remember a lot of Jewish protests necessarily about anything, they tend to be a little bit more active politically behind the scenes rather than coming straight out and protesting in general, you don't see them as an organisation or as a group necessarily do that.

But given that the only way that Jews can influence the oil industry is through the media …

Yeah.

… is there not a responsibility, are they also not responsible therefore for being more moderate in the way that some of their arguments are put across, or given

that the media is the only tool that they have to influence, is that why they can be seen as being very right wing and very antagonist towards Arab states? Does their non-involvement, sorry, in the oil industry mean that their involvement in the media is all the more stronger?

Yeah that's probably absolutely true because they, that if that's your only means of influence then obviously you have to push where you can push and you have to be able to try to, well, try to misdirect whenever you can.

If there were to be peace between Israel and Palestine and that peace was to sustain, do you think that there may be a softening of attitudes within the oil producing nations towards Jews and Israelis becoming more involved in the oil industry?

I think there's an opportunity if that were true that there actually were sustainable peace and the Palestinians had the state that they wanted and everyone was happy and it was true peace between 'em, yes they would have, I think there would be a softening of positions over time.

But it is far too fanciful and far-fetched to say that the Jews are hoping for a resolution to Arab and Israeli conflict solely so they can get involved in the oil industry.

Oh absolutely, absolutely. No obviously if you're surrounded by your enemy and your enemy's always yelling and throwing rocks and that type of stuff, your number one concern is to make sure that they don't invade, number one, and try to overrun you, but if there – that would be their main focus is to be able to live in peace in their own, what they believe is their given land, so I don't think that has anything to do with we get more in the oil industry obviously.

It would just be one opportunity to work on afterwards.

It would be a great consequence, right.

Is it not therefore ironic that during the Israeli occupation of the Golan Heights when the trans-Arabian pipeline was pumping oil over the occupied land that the Saudis allowed oil to be pumped over Israel territory saying that in actual fact it wasn't Israeli territory, it was occupied land?

Exactly, yeah, you can say what you want right, the reality is that they possessed it.

And within the States how much bankable or invested petro-dollars will go through the hands of Israeli and Jewish bankers?

Ah, quite a bit, quite a bit obviously.

So really there is only the core issue of really being able to work in Saudi Arabia that's preventing Israelis or Jews from actually being involved in the – whereas - in the oil business, whereas all the other supplementary industries like the money that is made from it is quite happy to be used through their systems?

Absolutely. Absolutely, right. So what is the one thing, the one problem that they have, they don't, the Israelis don't have control over any oil and so what are you going to complain about? I mean they get everything else, you're absolutely right, they get to touch and control some of the other aspects of it, so, quite interesting.

It's interesting for me as well because after the '67 war they acquired a large part of the Sinai Desert with their own oil fields.

Uh-hmm.

And they gave them back to the Egyptians.

Yeah and that's something.

Was that because it was so difficult for them to work in the oil industry?

No, no I don't think so.

That was just part of the big deal?

Yeah.

Because they got, because the Egyptians agreed then to provide them with a certain amount of …

Exactly, right and to leave them alone basically that's what they were after.

So the Israelis were able to run and produce their own wells?

Yeah, absolutely, they know how, right, they have experience from other areas, it's just they don't have it in that particular area. So if they really needed the expertise they could bring them in and utilise and then of course there's always mercenaries that would gladly come in and help.

So really if – no, there's no point in asking that, okay, thank you very much.

[End of File – 00:28:23]

INTERVIEWEE 'D'

Transcription of Interviewee 'D' 18/11/2008

Duration of Interview: 00:18:55

[Beginning of File]

Good morning and thank you for the interview, could you tell me whether the product that you manufacture has Intellectual Property Right Issues?

Yeah, we have a product range that covers nine or ten different products and we have both product and process property knowledge.

Could you please tell me where the expertise in your product lies?

Two areas, the first area is design, the products have to be gas tight that in itself needs certain 3D design elements.

What amount of research and development goes into actually making the product?

Our annual budget is roughly ten percent of our net profit margin every year, so our company typically makes fifteen, sixteen million net margin every year and typically one and a half to two million goes back in R and D.

What percentage of that business is in Saudi Arabia?

At the moment it's quite small, Saudi Arabia is probably only fifteen percent of our business.

Are you aware that the Chinese are producing any copies of your own product?

Yes, we've been to China and actually seen our own drawings in Chinese factories.

How has that differed from dealing with any other new manufacturer in the market?

It really hasn't made a lot of difference to us, the Chinese products we saw when we went to China were very poor quality, very low pressure and quite honestly without the intellectual property knowledge, experience, time, if they could catch up it would probably take them ten years to understand the intellectual property knowledge locked into our products.

Do you think the Chinese manufacturers if they work together with large western manufacturers will eventually be able to reach the quality standards of your own product?

The answer is yes and no. Yes they will over a timeframe, what that timeframe is, is well beyond my lifetime. My experience with Chinese is that on anything low technology, low knowledge they can learn, they can develop.

Do they have the same networking skills as western manufacturers do?

Do, the two big problems they have is the culture within China, it's still very much a secret society, so when people, businesses, do get hold of any property knowledge they do not share it, they like to keep it very much within their own.

Is the oil service industry a club? Is it a difficult club to go in or are China outsiders because of their culture or because they're relatively unknown?

The oil industry it's not really a club, the difficulty with the oil industry is that a lot of money goes into R and D and if you don't manage it properly you can do a lot of damage, so the Chinese won't be ostracised for anything other than they just want to steal that knowledge and try and use it and the effects will be catastrophic.

Do you think that the Chinese will continue to ignore copyright issues?

Of course yeah.

Do you think it would have been helpful during the education of the next generation of Chinese in western universities, in UK universities, if engineering degrees had incorporated a large amount of regulatory teaching, the importance of regulation?

Then you're into a different topic, again, yes it would be better, but you have to realise the background and culture they come from. So how you change that mind-set is probably more important than what you teach them, and one thing I found on my many visits to China is you can teach them, you can tell them, they'll agree, they'll sign contracts, but at the end of the day their culture is very much they will do what they want to do anyway. And that's not necessarily because they're bad people, I found in general they're quite honest, quite open and quite genuine, but their culture is copying is not a bad thing.

Are you prepared to go into partnership with the Chinese?

Oh we have no problem going into partnership with the Chinese, there's two big problem, the trend at the moment is to go into partnership with many and then control the intellectual property knowledge yourself because still there is a culture on, in China, the rich are getting richer, the poor are getting poorer and that's this cultural divide that I find all the time that no matter how hard I try, how many deals I make, how many people I see, there is still this background of the guy's in there, he will make money, a get out. There's no appreciation for their own culture, their own people.

Do you think that manufacturers of oil industry equipment in the west will be able to survive without involving themselves directly with the Chinese?

Yeah I think so, I think again if you look back over time which is always a good indicator we probably heard it with the Japanese and the motor industry, their culture is such that they now understand western ways, western cultures, they are now demanding western salaries and western comforts. So by and large there are new motorcycles,

new car industries picking up all the time, the only thing we did was managed it badly with Japan. We will manage it better with China.

Because we've learnt from the past experience?

Because we've learnt from the past experience.

Do you think that Chinese personnel who work on the actual fields will be able to work in Saudi Arabia no differently than US and European workers, is there culture up to that?

Yeah, as you travel around oil fields, you'll see Chinese people everywhere. But again the difficulty that you find is they can work with Europeans no problem, they can learn how to do the job, but the difference is there is no loyalty, their whole culture is money driven and when you see the culture in China you understand why. But these guys will quite happily leave an oil field, leave a site and move within a week or two for a few hundred dollars a month.

Is there much transfer of Chinese labour over from Chinese companies to European companies?

No, the Chinese labourer tends to be working for Chinese companies and these Chinese companies tend to get brought in when there is nothing else, it's a last resort.

So whereas you could get a European worker going to work for an American company, there is this transit of employment of the labour?

It tends to be economy of scale, so you'll find now when everybody's drilling, probably more prevalent a few months ago when the oil price was way up, the companies with a lot of knowledge, a lot of experience pay a lot of money, take the best guys and then it just floods, it just floats down the chain. So what happens is everybody sees the opportunity to make more money, they move up the ladder one rung, the bottom of the ladder is empty, so then the Chinese companies come in with their Chinese workers

but they tend to be in the countries that don't pay so well. So as you travel around some of the more …

I know what you mean.

… yeah, what's the?
Say for example the Sudan they'd go to?

Yeah, the Yemen, the Sudan, Algeria, places where it's …

The more politically challenged and socially challenged countries.

That's right yeah, yeah.

And my last question is what bothers you more, is it a Chinese cheap copy of your equipment failing and your reputation being affected by that, or the overall possibility of China beginning to maintain its own standards and competing with you on a more level playing field?

I think all the people I talk to in the oil and gas world and we all meet, it is a club, we all meet. Yeah so we all meet on our travels, we all meet for shows, it's a club in that sense, we all have these discussions, but I think there are very few people I talk to that have a problem with the Chinese culturally. The problem we have is that they won't respect the equipment and their copies – the two things they do is they're quite happy to do a one hundred percent copy including the label and the name, and the second thing is the quality control is so poor in some areas that one day there will be an accident and it will be our job to prove it's a Chinese copy. We try and say to people there is enough business out there to do it properly and to do it professionally and this is the trouble with the Chinese, the culture in a lot of cases, the last five years I've been travelling to China, I've seen the divide getting bigger and bigger and bigger, the rich are definitely getting richer, the poor are getting poorer.

So people are going to more desperate measures to maintain their standard of living?

Oh yeah, they absolutely do not respect this professionalism and I don't even see it in the young people coming through that they don't see anything wrong in getting to the political issue, you can't challenge them because the Chinese authorities don't see anything wrong in it. I've been to so many companies in China where companies I know, I've seen them badging their products with other people's badges to sell. But I think if they did it professionally, there wouldn't be a problem, there's enough business out there in this macroeconomic climate.

Does it make it any harder that many of the countries that import oil equipment for the field themselves don't have strict enough import rules to regulate what's coming in, if they traditionally know the pumps come from Scotland but they see them arriving in a crate from China, is it not their job to question that?

Yeah I should think it is, yeah, and by and large people we see are very aware, in the early days, maybe ten years ago, they turned a bit of a blind eye to Chinese products. What we've seen over the last ten years is some very, very big accidents that by and large don't get reported. So whichever country you go into and there's some of these countries they just maintain radio silence, they're banned by governments from printing stuff. But we know within the industry what's happening and there's been some pretty horrific stories going around. And people are becoming more aware now, so.

Can you think of any particular case study that you can sum that up with, has there been a particular incident?

Well I think the most recent one was in Algeria where the first - one of the drilling rigs broke some very – it was a Chinese copy, it had very poor quality control and the hydraulic hoses broke on the top drive, the hydraulic oil sprayed all over the rig including the hot diesel generators and a fire broke out.

So you had a well fire?

We had a well fire, what we heard was that rig was then repaired by a reputable company, they weren't allowed to do all the safety checks they wanted to, they repaired the hoses with very professional hoses, they looked as close as they could and inspected what papers they had, but the other thing you find and we've got first-hand experience the documents from China are not worth the paper they're printed on, they repaired the top drive, they started drilling, the hydraulic pressure came on, but this time instead of the pipes breaking, the power transmitted to the rig and it just twisted the frame of the rig and the rig fell over, and this is not untypical. We've had first-hand experiences where we have had certificates of conformity stamped, witnessed by reputable bodies, these people have quality control certificates from quality organisations. And if you look on any website you'll see the Chinese advertising they have all these quality standards and certificates but when you get it back into your factory and do an investigation, we've seen pieces with holes in them that could never have passed a pressure test where we have a certificate stamped and signed to say it did.

Is there anything that the trade missions within European embassies could do to put pressure on receiving countries to prevent your own products from being tainted by this?

I think it's one of these things, the problem is so big and the political or the economic environment drives it to a point it can't be controlled. I can remember not so many months ago when everybody was drilling at two hundred dollars a barrel, one hundred and fifty dollars a barrel, everybody wanted people, there's a distinct shortage, we have our own rig fleet in Europe and to get qualified personnel for us is very difficult. We only use qualified people, we have to pay a lot of money, but we get a lot of companies further down the chain that report to us that well okay we know the guys from China and National Drilling, we know he's only been on the rig three months but that's the best we've got. And this is the market drives it and I don't think anybody has the power to stop it.

So the highest time for risk in this business given the shortage of manpower is when there is a high demand at a high price?

Yeah, high demand, high price, high requirements, high risk.

Dropping the quality of labour used?

Yeah and that's a knock-on effect …

They use Chinese labour?

… we deal primarily with all the major players around the world and they understand the need, high pressure is a bomb waiting to go off. And this is the problem when you talk to the big oil companies, the Exxon Mobils, the Shells, the BPs, they have all their environmental policies in place, they have all their health and safety which is their number one and we have to conform to that. And we believe in it because quite simply I do not want to knock on somebody's door and tell them that their husband or wife has been killed. But further down the line companies that maybe don't have such exacting standards as the big companies relax to a point where the bottom of the chain, they'll use whatever they can get and if that oil price is at a hundred and fifty dollars, they don't care, they'll take anything.

Do you think it may have helped if the larger companies who went into partnership with Chinese companies or built factories in China, would it have helped matters if they'd have built them in Saudi Arabia and had Saudi nationals working in there?

I think you're then into, yeah, more political discussions, yeah, I think maybe the attitudes in Saudi are certainly different, we're certainly looking around the Middle East to do joint ventures. We have another factory in the Middle East now, we don't really have any problems, we're happy to share the information, the technology, the people we deal with, they want to learn for the right reasons and they know it's going to take time, but that's an attitude you won't get in China.

Okay, so there's quite a distinction, my very last question is it's been put to me that if a product can be made in China a lot cheaper than it can do in the UK that's acceptable by a lot of people, but what will the UK lose by that?

What? It will lose a lot of jobs. What will it lose? It'll lose credibility because if you're not careful, maybe making ballpoint pens and plastic rulers is acceptable providing you make sure that the higher technical infrastructure is behind it to follow. But what I see is more and more people pushing the boundaries to see how far they can go with cheap Chinese products. And there will be a point where China is perfectly acceptable for making products that don't have any implication for health and safety, but that means – we put a lot of money into R and D, and that when I listen to the news and the companies, it's really self-destructing because the more product that goes away to China, the less profit there is for R and D. So there comes a point where you have to make a distinct choice either more R and D and develop your products or risk going out of business.

So where is the main threat as you see it from China?

I think the main threat is going to be at the low end of the technology scale, I think the high end technology they're starting to learn that their products are being banned around the world because they are just not safe. So I think what we'll see is a development back to basics, they'll start I think trying to learn what to do, but how long does it take to change a culture? That's why I say I don't think I'll see it in my lifetime.

Thank you very much.

[End of File – 00:18:55]

INTERVIEWEE 'E'

Transcription of Interviewee 'E' 17/11/2008

Duration of Interview: 00:08:59

[Beginning of File]

Good afternoon. If you could please introduce yourself, your name and your company?

Yeah, my name is [inaudible 00:11] 'E' and I'm the Area Sales Manager for 'EE' Middle East for Middle East and North Africa region.

Could I please ask whether your company considers Chinese manufacturers to be a friend or to be a business challenge or enemy?

Well, I think there's no–one as enemy, I can say is a threat.

A business threat?

Yeah, but at Sulzer Chemtech we realise that China is a very important market, it has certain benefits for us to also take away from them. Sulzer Chemtech basically is a Swiss based company, we have a manufacturing base in Switzerland and Poland and Mexico, India looking at the opportunities in China itself which I mean the refining operations where we can supply our own internals and benefits which we have make it as a source for manufacturing.

We have also put up a manufacturing base in China and we're capitalising on that. As of now to supply in the Asian region we're not getting into the Middle East and North Africa as we speak except for certain components like [inaudible 01:26] which come from China, otherwise the majority of our products for GCC in the Middle East, North Africa, I'm talking, we are supplying from Poland, Switzerland and Asia.

If Sulzer had decided not to go into partnership with China, what do you think that would have done to the company in Saudi Arabia?

Well, as I said, the market in Saudi Arabia is not catered by China fabrication but I would say China was a good opportunity just like India is and together, as I say, AP upper region, Australia, the Asian region, to cater to that area China is becoming a very good focal point for us. If we were not there, well we would have not been so competitive and the market competitors would have gone way ahead of us because if you're sourcing from Europe to cater to Asia it's not going to happen.

Do you think that large companies who decide not to go into partnership with China face the prospect of being isolated not only from the Chinese market but from the markets where China has come into partnership with foreign companies. For example, if you don't trade with China is it any harder to trade with the US?

Yes, I would say yes. If you are not trading with China you will not be competitive in the international market unless you are catering to a niche area. If you're a global corporation I think I fully agree we need it but, if you are only working to say American market or some other regions say only European market, then you have a choice of being isolated from China.

Do Sulzer have any niche areas that they are not sharing with the Chinese?

No, we are sharing everything with the Chinese, there's no niche areas where we are not sharing. Only for the geographical reasons we are not using China as a base for Middle East and North Africa as we speak.

Are you aware of the suspicion within Western manufacturers that China can produce very cheap copies of Western technology?

Yes, we are aware of that but at Sulzer Corporation we have seen quality HSE procedures which we are using at Winterthur, Poland, India, Mexico and in China so we adhere to same quality standards worldwide.

Has a copy of a Sulzer component ever been brought to your attention that was made by somebody, a counterfeiter?

Not really, not to my best of knowledge.

And would you say that Switzerland has gained a benefit from Sulzer being in partnership with a Chinese company?

It's not a partnership but it's a whole fabrication base so that's what I meant. You know, our fabrication in China, India or Poland or in Winterthur Switzerland is identical, the same machines, same HSE, same quality procedures, same testing procedures.

But will the Chinese in Switzerland, the Chinese Embassy, will it be easier for trade negotiations because Sulzer has a factory in China?

It will, yeah.

It will benefit in the more diplomatic areas of trade and performing relationships. Was trust ever an issue with Sulzer when they went over to China?

No, not really.

Do you think that it makes a difference the size of your company who are a huge large manufacturer, is it easier to go to China?

Well that's a difficult question to answer but from my point of view I'd say yes it makes a difference. If you are a large corporation you have better procedures in place whether it's legal, it's contractual, it's technical and we have the same systems picked up from Europe and taken into China, with some modifications obviously, and we have the Chinese management also which has grown very successful, doing an excellent job in technical sales and research and process design and we're doing a good job. So far it's been very successful for us.

So in all, when China came into the market it was always seen as an opportunity, it was never seen really as a threat by Sulzer?

No never, we just saw it as a big opportunity for us and we capitalised on that, putting up our own fabrication site there and we catered to the Chinese market first and now we're extending it to the other locations.

How do you find the quality of steel that is being manufactured in China?

Well, we have our own procedures to qualify the mills from where we take our raw material and there are certain customers who do stick to European customers especially or American customer, they stick to European source of steel and we have no problem with that. We give them the [inaudible 07:08] anyhow at Sulzer we take it internationally, wherever we get the best price and the best quantity which we are looking at a particular time.

And China is part of that, are they?

Sure.

They can produce steel of good quality?

Yes they do. I would just like to make this point, China or any other Asian country for that matter, even India, we have good and bad companies like anywhere else in the world and you as a company have to decide to get the good companies. We can go and do our own audits, our own test and random checks and them to qualify a company from there we are taking raw materials.

Can I ask you if there was anything else with Sulzer's relationship with China which was unexpected or came as a surprise?

Not really, we were well prepared actually, now in this day and age we can get all the information we want. There are some handicaps if you go to any of these countries,

one is language problem and there were a few issues which were there but we were well prepared and we didn't have any surprises in this area.

How did you find the culture when dealing with the Chinese?

Yes, the culture, as I say, when you go to a foreign land you have to get used to that culture whether it's China or India so you have to get used to it, you have to work with their culture and [inaudible 08:49] of China comes Middle East, comes Saudi Arabia, we have to live with their culture, talk to them in their language and we do the business for them here.

Thank you very much.

[End of File – 00:08:59]

INTERVIEW WITH MR. A THONAYAN

NATIONAL SHIPPING COMPANY OF SAUDI ARABIA

NOVEMBER 8th 2008

Transcription of Interview

A. Thonayan

18/11/2008

Duration of Interview: 00:23:34

[Beginning of File]

Thank you for giving me your time for the interview.

My pleasure.

Could I ask whether you have any concerns regarding the new design and new build of double hulled tankers when compared to the old design of single hulled tankers regarding their overall safety and whether you think that a change from a single hull to a double hull tanker was appropriate for the Gulf region?

Well, from my point of view as an ex–sea farer, the main reason behind having the new design for a [inaudible 00:37] which is a double hull just for closure, nothing else. It doesn't concern the marine environment, the sea life or the particular ship, it's just for closure, just to make two double sides.

Do you think that the structure within the hulls will be harder to survey and regulate against corrosion than was previously the case?

Yes, indeed, but if you go on board one of the new design ships which is a double hull, the main idea is that the cargo tanks are in the middle and all of these cargo tanks are surrounded by double hull. These hulls, they put the ballast water inside these tanks

when the ship is the [inaudible 01:26] on board the ship so to stabilise the ship they put the water inside these tanks which is in the double between the two sides.

From a stability point of view it's not as good as the old design which is one single hull and that all of the steelworks in these new designs it's a bit complicated because it's a very narrow area and a very congested area, especially when it's around the bends, around the keel and around the bottom of the ship. That area is going to be very difficult for surveying. That's the way I see it.

Is it possible that due to the price of steel and the extra expense in making quality steel that new build tankers will suffer from inadequate steel in the future?

As I told you before, they were using two types of steel, high tensile steel and mild steel. I believe if man was taking the mild steel, which is the thick one, and the high tensile steel which is the thin one, they are all having the same strength but the wastage rate is the same so sometimes maybe it's better to have the mild steel instead of the high tensile steel but let's say it's a commercial point of view to reduce the weight of the ship and have more cargo instead of steel. I don't think you would have any different steel, it's all the same because the thickness must be the same.

Is the infrastructure within the tanker inerted in the same way that it was inerted in a single hull tanker?

Exactly, yes.

So the whole structure is inerted?

Yes. When the ship is loaded the ballast tanks don't have to be inerted but when the ship is in ballast and all of the cargo tanks are empty the old design used to inert only the tanks by the side, not the centre tanks, but in the new design they may need to inert the cargo tanks because it's double hull so even if you have a gash, if there is a little possibility to have hydrocarbon leaks from the cargo tanks to the ballast tanks, that's the main item. Sometimes it costs you money to inert all of the tanks because

the consumption for the tanker is going to be high so let's say to inert all of the tanks after [inaudible 04:09] it's going to be maybe ten thousand dollars for [inaudible 04:11] tanks.

Is there more possibility for products to leak into the internal structure of a double hull tanker because there are more spaces and for those leaks then to create fumes which could ignite at a later stage?

Well, any leaks are going to be hazardous whether it's on a single hull or a double hull but if you're talking about a crude oil tanker and product tanker then I'd say the only difference is the flashpoint of the flammability for the accident.

During the 1980s there was a tanker was in the Gulf –

Yes.

– do you think double hull tankers will react any differently in that situation if it was to happen again?

No, the missiles are becoming stronger and stronger than before so even if you have a catastrophic attack on-board a ship whether it's single or double hull it's going to be catastrophic.

But will it cost more to insure or repair a double hull tanker?

Yes indeed because the steelwork and sophistication on board the double hull is more than single hull.

So there is a chance that vessels could be easier to make a certified total loss with a smaller damage because it costs more to repair?

Yes, more likely.

How would you envisage the Classification Societies and the Insurers would react if there was large scale targeting of oil tankers in the Gulf again?

Well, if we're talking about Classification Society, they all have the same opinion about explosion so they have to follow the IM Organisation, the International Maritime Organisation for the safety of life at sea. If the Classification Society does not comply with these regulations they will not exist so they have just to [inaudible 06:15]. It's mainly for [inaudible 06:18]. [inaudible 06:19] for the double hull [inaudible 06:22], nothing else.

Has Saudi Arabia adopted the port state control for double hull tankers?

Well, as far as I know, we have some sophistication with the Saudi law because in Saudi Arable we are following the Sharia law so sometimes it's like the contract State [inaudible 06:45] rules or [inaudible 06:46] rules, Saudi Arabia maybe has accepted these rules but not classified them yet.

Would you say that from a seafaring point of view Sharia law is in conflict with International Maritime law?

No, I wouldn't say that because Sharia law is very simple but the problem here is with the people who are understanding the other laws so, if sometimes they are having difficulties to analyse what do they mean by this and that. So sometimes they say to be on the safe side just stay away from it. But it's not like that, Sharia law is very simple but the main difficulty is for the people to understand how to interlink between the Sharia law and international laws.

What would happen to your business if the Iranians blocked the Strait of Hormuz?

Well, to be honest with you, for our company we are just shipping company so the company is owned by a government twenty eight percent but we are shipping company so we are a profit making company. We don't need to ship from Saudi Arabia, we can ship from anywhere else. You know, sometimes we do the shipping

from West Africa to the States or from West Africa to the Far East but, if you have problem with the loading ports, Ras Tanura with regard to Saudi Arabia, we can load from Yanbu or we can load from [inaudible 08:26].

Do you think Yanbu is a realistic alternative to Ras Tanura?

More likely but, you know, the main difference between Ras Tanura and Yanbu is the capacity so sometimes the ships may have to wait some three to four days to wait for their cargo but in Ras Tanura cargo is already over there so maybe that's the only reason. And we have five berths at Yanbu and one berth in Arabia and at Ras Tanura we have four berths, Sea Island, and five SPMs so let's say they have nine loading berths and at Yanbu we have five.

Are there any other risks in the region of Yanbu to take into consideration?

Well, not really. All the way to [inaudible 09:32] there is no risk.

What about in the Gulf around Ras Tanura, there is a universal understanding that the export of oil is beneficial to the economy of the countries involved in the Gulf producing States –

Yes, indeed.

– Is that the case around Yanbu?

In the Red Sea the only port for oil is Yanbu, nowhere else. In Egypt, in [inaudible 10:05] we discharge the oil we are loading from Yanbu in [inaudible 10:09] and it's being carried by pipes all the way to [inaudible 10:12] on the other side in the Chinese sea. There is no loading port in the Red Sea other than the Yanbu.

How do you see the realistic possibility of terrorism affecting the oil tanker business?

Well, terrorism is hitting everywhere, even it is hitting the refineries, the storage farms,

so I believe the security in Ras Tanura is higher than the security in Yanbu because Ras Tanura is the backbone of Saudi Arabia. Yanbu is just a loading port but the size of the tanker farm is not comparable to the size of the farms in Ras Tanura.

How about piracy?

Piracy in the Red Sea, minor.

Even though it gets the headlines, in actual fact it is a small risk, you see it as being a small intermittent threat?

I see it as small risk in the Red Sea but around the Somalian coast and around the Gulf [inaudible 11:26] and around the Kenyan coast it's high risk and one of these ships has been hijacked recently.

One of your own ships?

No, one of the other ships.

Do you think that the threat of piracy and even when it happens is used by the media and is amplified?

Yes, it's always like that by the media. The media sometimes talk when they want to talk and they talk the way they want to express their own personal view and sometimes though they listen to what they want to listen to not what is there.

So I wonder why it is, and you may help me, after the terrorist attack on the Limberg off the coast of Yemen, why this wasn't repeated again later on?

Yeah, that's why I'm telling you maybe it's not a terrorist attack, maybe it's political issues and tensions between governments. You remember when the Americans planned to invade Iraqi, some countries were against that, one of them Russia, China and France, so maybe that's linked to the accident with the Limberg.

Or could it be that the attack on the Limberg had very little effect on the oil industry?

Indeed, very little effect.

Now I have some questions which they may even be yes or no answers. If I said if Iran closes the Straits of Hormuz and the Iranian forces target oil tankers, will this affect Aramco's operation?

Yes, it will.

If the Straits of Hormuz were to close how would Aramco react, would they have to shut down their business, their production, and would their tank farms become full?

No, because the main reason Aramco wouldn't be affected is because the tank farms and the oil fields are around the Arabian Gulf so if they have to extract oil and do more exploration in that area all of the oil has to be pumped somewhere else, to Riyadh farms or to Yemen farms and kept there. They may have to limit the capacity of oil being stored in Ras Tanura or in [inaudible 14:20] because if Iran target the shipping industry they may target the oil industry itself and their finance.

If double hull tankers are proved more susceptible to damage than single hull tankers, do you think this knowledge would make Iran specifically target?

No, because as I told you before, from my point of view, from my little experience, it's going to be the same between single hull and double hull.

If double hull tankers prove to be more susceptible than single hull tankers, do you think that this would prompt terrorists to attack them more often?

No, because terrorists don't know whether it's double hull or single hull, they cannot tell.

Would it make much difference if they did?

No.

How would you say currently the oil tanker market is reacting to the change in direction for oil instead of going to the Western consumers but moving to the East, is the tanker market adapting to that well?

There is a high demand from China and Korea for crude oil and there's a high demand from America for the Saudi crude oil so sometimes we do the shipping for African oil, from West Africa to China, but America is always interested in the Saudi oil away from the Arabian Gulf so I think the trading pattern has been always there whether it is to the West or to the East.

Is it not my fate that the Gulf is ideally placed to serve both Western customers and Far Eastern customers as well?

Yes, the location of the Arabian Gulf is very strategic for East and West.

So, therefore, does that not make Yanbu even less likely to be developed because it's between the Suez and the Gates of Tears, Bab–el–Mandeb?

Well, if you are talking about the [inaudible 16:54], Ras Tanura is going to be at risk from the Iranians but Yanbu is not going to be at risk from anyone, the only risk is coming from Somali coast but not nearby Yemen. If you are talking about closing the Suez Canal.

No, I'm just saying that once you have gone through the Straits of Hormuz you're in the open sea –

Yes.

– when you load at Yanbu you either have to go through the Suez and through the Mediterranean or straight down to Bab–el–Mandeb.

Let me tell you one thing, if a ship is fully loaded by crude oil from Yanbu she cannot go through the Suez Canal, it's very deep. The ship drops, it's about twenty one metres which is not enough for these ships to go through the Suez Canal so they have to discharge at least half of the cargo and cross the Suez Canal or they have to discharge the whole cargo in [inaudible 17:56] and some other ship will take it from other end but, if a ship has to go through the Bab–el–Mandeb she has no problem.

My last question. In the past, regardless of the disruption in oil production to Gulf producer States, oil tankers have always been able to export oil from the Gulf –

Yes.

– even, for example, when Kuwait was invaded by Iraq there was extra oil production in Saudi Arabia and the tankers were always able to go through the Straits of Hormuz and out into the sea. Do you think over the years that the fact that tankers have always been able to export oil has added to the instability within the region?

And I say this because no matter how hard people try to harm each other's country by stopping their oil supply they have never yet managed to do it and, for as long as oil reaches the consumer States, mainly in the West, the consumer States are very unlikely to get heavily involved in the internal politics of the producer countries as long as their oil is coming out.

Yes, that's correct.

So do you see the continued export of oil with oil tankers as being detrimental to the political stability within the region?

In the Arabian Gulf, if any state decides to affect the security in that area she is – as I say, it's [inaudible 20:20] rules so they have to cooperate and maybe next five year

behind having another loading port in Saudi Arabia which is why they have built a huge pipeline from the east of Saudi Arabia all the way to the west.

But I say again, from the point of view of the consumer countries, as long as they are having their oil, does that regulate how much they will get involved in the internal politics of Saudi Arabia? They will not, for example, they will try very hard in other countries to create democracy –

Yes.

– but in Saudi Arabia, as long as they get their oil they will allow the country to remain?

Yes, that's true. If they have an interest they have to make sure that everything is stable there and they don't want to interfere with their business. We get our oil, we're happy. That's why sometimes if you see any news about the tension between the Iranians and the Americans the price of oil is going up so as long as the West are getting their oil.

Do you think the Iranians could close the Straits of Hormuz?

No.

What do you think the probability of that happening is, on a very large going all the way down to very small?

Let's say fifty fifty. I don't think they would close the Straits of Hormuz as long, as there is no war between the Americans and Iranians they won't close the Straits of Hormuz.

And Iran would come under tremendous pressure from the producing countries in the Gulf not to close the Straits of Hormuz?

But will they listen? No.

Would they have the capability to stand their ground?

You know, after the Iraqi war between Iraq and Iran most of the Gulf States were supporting Iraq so, in my opinion, I believe from that time Iran is having an attitude from the Gulf States.

Having an attitude?

Yes.

Are you worried about Iran becoming a nuclear power eventually? Let's say for example they did, would this bother you?

From my personal point of view, no.

You don't think they would use their nuclear ability in a threatening manner towards the rest of the Gulf States?

Because if they use that nuclear power it's the end of the world, in my opinion, because where oil comes from, from the Gulf area, and if there is war there the whole world will have to be to war.

[End of File – 00:23:34]

INTERVIEW WITH MARTIN STOPFORD

DIRECTOR OF RESEARCH

CLARKSON'S SHIPPING

MARCH 8th 2010

Transcription of Interview

Duration of Interview: 00:53.15

[Beginning of File]

Interview with Mr Martin Stopford, Clarkson's on the 8th of March 2010. My first question is where do you feel the main risks are for the tanker industry, operating in the Gulf today?

The, well the biggest single risk obviously is the closure of the freights, [inaudible 00:25] for some reason, that would be number one simply because that terminates the trade. Second major risk is the escalation of piracy, which has been going on, on an increasing scale and one which is more than academic in convenience now and has become quite a sizeable business and you know the fact that you've got two unstable territories on both sides of the Gulf and that clearly there's no political ability to deal with it very well at the moment, so I'd say that was number two. The transit in military terms – I mean the Gulf proved not to be a major problem during the war in the 80's, so I think one – and I don't believe you know the generally available weapons have changed all the much, so one assumes that modern tankers could cope with a degree of hostilities, as they did then, so those are the three that occur to me.

Okay, thanks. Would the tanker industry benefit from Gulf oil producing states building additional loading terminals, outside of the Gulf area? In the same way that the Tapline took Gulf oil up to Lebanon?

Well the first thing to say about that is that you know Tapline proved to be extremely vulnerable in itself. Pipelines on the whole are the most vulnerable parts of the oil

transport system, because they go on [inaudible 02:12] and steam out of port you know. So I think you know if your objective is to improve security, I would have thought that pipe lines would be a difficult solution. I mean all of the pipe lines have a difficult history, look at the Turkish pipe line.

Yeah.

Turkish transit, pipe lines have to go through somebody's territory and on the whole, the territory that they would go through to get to the Indian Ocean is not really a more, is pretty unstable politically and I think to be honest, the same is true on the Mediterranean, you know. So I wouldn't put pipe lines all that high on my list of strategies for resolving the issues, you know.

Would it benefit the industry though, if there were extra loading terminals, by way of hiring ships at sort of cycles of – or would it complicate matters?

Well it makes a difference, I mean it's very expensive to ship oil long distances by land and it's a goodly distance. If you wanted to take a pipeline from Saudi, then I guess you could ship to the Red Sea, that's a – I mean they already do have pipelines over to the Red Sea, so possibly building more pipelines in the Red Sea is you know – that's one way round. But as I say, anybody who is resolute to close the freights of [inaudible 04:07] would probably be able to cope with pipelines pretty well too, so on the face of it, I don't see that being a real solution in any sense actually.

Okay. My third question, the Iranians often threaten to close the straights of [inaudible 04:29], how would you expect the tanker industry to react if such a closure were to happen?

Well if the [inaudible 04:38] close, then you'd have two consequences, the first is that no oil would come out, I mean that's the first one. The second one is that a certain number of tankers would be trapped in the Arabian Gulf, how many I couldn't guess, but there would be some loss of tonnage. So for the oil industry as a whole, the immediate priority would be to find alternative supplies and so you know you've got refineries running. I think the loss of Middle East oil supply would cause a very major

international crisis and I think that no doubt major importers would slam on restrictions on their end initially, to try to dampen down oil demand as much as possible in crisis measures, to ration the use of gas and that sort of thing and at the same time, the oil companies would search for alternative supplies, but there isn't an alternative supply that could take up the slack that you'd lose there.

So I guess temporarily you would still be in a rather strange situation, because on the one hand you'd have a great surplus of tankers, which would normally be carrying oil from the Middle East to the North Atlantic to Asia and these are the longest haul, so it's a lot of the capacity and they're very big tankers. At the same time the oil companies would be searching around for any possible supply of oil that they can get from anywhere else at all, at any price and to a large extent, that might cause a shortage of small tankers, because you know many of the short haul suppliers don't accommodate the very biggest tankers easily. So if you took out the Middle East, you might find there are imbalances from that point of view.

So I mean those – in terms of how that panned out for the tanker owners, generally I mean the third thing that would happen is people would probably start storing oil as much as they could at sea, you know people tend to hoard when prices go up, because the price of oil would go to an undetermined level, so the speculators would come in and start storing oil and that might very well result in stocks being held at sea. But again it's a trade-off between the fall in supply, the lack of fall in demand, you know will there be enough oil to stock pile? I can't tell you but you'd have a very complicated situation would develop and my guess is that on the whole, owners would probably do okay out of it, that the price of the freight rates would probably shoot up and in that situation, I'd rather have a small ship than a big one.

Okay. I have two questions from that, firstly would people begin to invest in shipping companies short term, as a result of that? The city for example?

I think probably – I mean it's such a difficult question to answer because of the facts that – I think probably if that happened, given the size that Middle East supplies, which I forget exact how much it is, but it must be 15 or 18 million barrels I reckon. Tell you what, hang on, if you hang on, I'll tell you what it is.

I think you're about right.

It's 18 million barrels is it?

It's about, yes it is.

Yeah well look I mean we consume 86 million barrels a day, you take out 20% of oil supplies, you've got you know hardly any inventory. You know, you've got the strategic inventory and you've got some at sea, so we have a problem of cutting back world oil demand by about 20% instantly. It doesn't sound all that unmanageable and so I think the answer to your question is how people perceived the closure. I mean if it was perceived that whoever is the powers that be would send in a military force and clear the whole thing within three weeks, then it may be people would be reluctant to invest too much in tankers.

Would the nuclear element come into that then?

I mean I think there's a lot of other things you might look at, in terms – I mean nuclear – are you talking about…?

Iran, yeah. Iran's nuclear programme basically. Would they have a greater hold on what was going to happen or how long they were going to close the straights for example?

You mean if they closed it by dropping a nuclear bomb in the middle or something?

Or threatened to or just the fact that they have…

Well I think if you got – I mean basically if you've got a major stand-off, which looked as though it was going to drag on and people are notoriously bad at judging these things, I mean nobody really knows – I mean you'd have panic. We've seen it in the recent crisis, you saw it in the 1956 crisis, that people panicked and the belief of the oil companies, well documented belief of the oil companies after the [inaudible 10:40]

canal closed in 1956, was that it would be closed for four years, because they didn't believe that Egypt was capable of actually managing the canal and clearing it. While in fact you know it turned out that Egypt cleared it by the following April, so it was no sweat and people lost very heavily on that.

So I think a big factor in this is the behavioural factor, how people perceive the crisis and if they took a very dim view of it, which they might if there was nuclear issues. But you've got to remember that you close the straights of [inaudible 11:20], you shut off all supplies to – Iran doesn't have its own oil refinery capacity, it brings it in from all over 40 different countries, all over the place. The food supplies into the Gulf, you know man cannot live on oil alone and so you know there'd be no container ships in there and so basically you would be subjecting the Middle East to the – except possible Saudi bringing stuff through the Red Sea, to the same sort of crisis that you had by putting sanctions on Iraq you know, only worse really.

Is it something that you worry yourself over Greg?

In the great spectrum of things, I wouldn't say that – I find I've plenty of things to worry about, but I mean my policy is not to worry about what hasn't happened. So I mean I think that the Middle East has proved itself to be an unstable place for very good reasons, there's a lot of money out there, they're small populations, they're potentially unstable populations, because of the way they [inaudible 12:43], so it's a very, very difficult situation and I think on the whole we've been lucky to manage it as well as we have so far. Having said that you know, it probably would do the world no harm at all to have a crisis and cut the oil demand by 20%, to be quite honest. I mean in terms of – you know it's a bit like saying if you got stuck on a desert island with no cigarettes and you were a chain smoker, you could say this is terrible, but actually…

It's doing you a lot of good.

It's probably doing you a lot of good and I think that in the end, the real sufferers of something like that would be the Middle East oil states, because I do believe under sufficient pressure, the world could manage on 60 million barrels a day quite easily. It couldn't manage with the lifestyle it had, but you know it's a pretty profligate lifestyle,

you don't need to have a cottage in the South of France and go there every weekend on Easyjet you know. That's just something that's grown up, you don't need to drive to 80 miles an hour, you can drive at 40, you can go on the train and you don't have to turn your central heating up to 70 degrees all the time. There are lots of ways I think that it could – whereas the people who – so I think the west in the end, it would be very, very painful but you know the world could adjust.

The Middle East I think would be left with a major stigma and it would of course have massive effects for them, because they are not a self-sufficient economy in any – the Gulf States are not self-sufficient in any sense and so – and so I think it could be quite difficult actually.

If I can go back to what would happen actually if there were to be a closure and if I can talk about what would actually happen to the tankers in their individual different positions. In relation to how they may be utilised, or what may happen to them regarding trading and if I say what would happen to any empty tankers that were trapped in the Gulf?

I mean perhaps I should have said at the beginning and I'll say it now since you're recording this, that you know I'm giving you my best estimate. I've been around a long time, I've followed the thing a long time, but these are difficult questions and so I'm giving you top of the head answers, not carefully considered and researched and answers and I hope you'll take them on that basis.

Yes, most certainly.

What was the question again?

It's what would happen to any empty tankers that were trapped in the Gulf?

Well they would be left there basically and probably taken to a port, laid up.

Used as storage for example?

Well I think you might charter them for storage, I don't know whether they would – I think that would be a logical thing to do, if it was felt to be a short term event. I mean militarily somebody might arrest them. When the [inaudible 15:53] canal was closed, there were [inaudible 15:56] caught in, I don't know they were 10 or 12 years in the sea of whatever it is, in the middle of the canal and you know ships caught in transit and they just had to leave them there. So I assume that their ownership and sovereignty would be respected, I mean those ships are actually [inaudible 16:22] their little islands of the flag state.

Of course you might also find there's a bunch of American warships up there, which is another – or British warships, or French warships you know?

Yeah.

So what do you do then? I suppose they could support those, so I mean I think there's a whole dynamic about what happens there, but I would assume that the Gulf state, or at least one or two of the Gulf states would honour…

Honour the sovereignty of the vessel?

Honour the sovereignty of the vessels, somewhere like Abu Dhabi for example and say you may lay them all up in Abu Dhabi you know.

I suppose we could say the same for the loaded tankers, but what I'd like to ask is would there be any trading on the oil that was in the tankers during this time? Would the oil become any more valuable if it was trapped in the Gulf or?

Well I mean – I think given that you can't get it out, you have a major – well I think probably the way to look at that is to say okay, you've put – I mean if you've got a closure like this, then you have to assume that there's been a degree of nervousness before. It seems unlikely that it would.

Right, yeah.

And if so then the price of oil would have gone up and therefore you're sitting on two million barrels of oil and a VLCC, which if it's a 100 dollars a barrel, that's a lot of money you know. You're talking what is it, two million barrels, 200 million dollars of capital, so the question I would think you ask is how do companies caught in that way, deal with funding the working capital on oil that they have purchased and can't sell and would the insurance companies cover them and what would be the consequences from that point of view and I think that would be commercially disastrous for people, if it was anticipated this would be a lengthy period. On the other hand you could well find that if you found a secure anchorage and you could take a gamble that it was not going to go on long and you could go and load up with a load of dirt cheap Kuwaiti oil, because the Kuwaitis would perhaps be keen to get some money, because they of course…

Wouldn't be able to export?

Well yeah I mean basically, I mean if you want to explore this one, look at the cash flow of these oil states. They all have big budgetary commitments and you know Saudi export six million barrels a day of oil, seven, eight million barrels a day of oil and if that stops, then from the day it stops, they stop getting any money in and people will no doubt you know, some would be difficult about payments. So suddenly these guys, the Gulf is without any visible means of support. It can't export from its – you've got Saubic with its chemicals, you can't export your chemicals, you've got your oil refineries in the Gulf, which can't export, which are relying on that, you've got no containers coming in, so you can't repair your cars, because you've got no spare parts.

You know you've got a complete nightmare scenario and anyway you've got no money coming in and every day you don't sell anything, so if it goes on for a year, you're going to have a siege economy in the Gulf I would think. I mean maybe Saudi would build motorways from the Red Sea and maybe you could bring stuff in across Turkey into Iraq. Iran I suppose I would have taken measures, but how long could Iran, how could Iran operate as a siege economy? You've got Pakistan on the other side, I mean you'd immediately block aid, I mean I imagine there would be some sort of blockade on all the possible over land troops if it was a military situation.

So it seems to me a very problematic situation from an economic point of view you know?

Yeah especially if you happen to be the Iranians?

Well as a sustainable thing, it's going to be difficult and in the end, if it came to – I mean I would have, at first shot I would say if it came to a bare knuckle fight and you know people knuckled down for the long haul, then massively painful though it would be, so much of the oil say in the States is tied up in land transport, which in the end you can drive less. You know, you can just half your mileage, you just don't go and see your in-laws, which is actually probably an absolute wonderful thing you know. So and people share cars, people go on trains, people stop flying and you save your 20% and you pump up your production in other areas and whereas you know, but you still have the benefits of the global supply system. Anybody the other side of the straights, it's only what you can fly in and are you going to – what happens to the air services? If you close the straights [inaudible 21:55], are you still going to be able to fly planes in you know?

Yeah, yeah okay and empty tankers bound for the Gulf, we've already discussed that they would probably be re-routed somewhere.

Yeah they'd definitely go somewhere else yeah.

And any loaded tankers that have just escaped the blockade, there would be a bidding war you think, between the traders on the price of the oil that was coming out?

Yeah, I think basically you would have massive oil instability, which would lead to hoarding and all sorts of stuff, because the traders and you know the traders – this isn't oil that's owned by big responsible oil companies, it's oil that's owned by all sorts of people and it may be that there would be some sort of intervention, I don't know. I mean these are scenarios that need thinking about and in fact I wouldn't mind a transcript of this if you ever did one.

Yes it will be.

Because it's, because we have a customer who is quite interested in this sort of thing actually. So yeah I think that you'd have a very market orientated situation and the big question is would actually you get military intervention? I mean would you get state intervention, to say nationalise all oil supplies in some way, or bring oil, if it was that serious, you know.

Right, yes I see what you mean, it would get to that…

Would it be left to the market or would they say this is such a serious thing, that we're going to basically nationalise all oil at sea and the United Nations will you know, United Nations has a crisis meeting and they authorise Naval Task Force to…

Would that have an impact on the shipping industry?

Well yes of course, then those ships would become under the control of the Governments, as they have done in wars previously. I mean you're in, basically you're in a war situation. I mean if somebody [inaudible 24:12] closes the Gulf, you're in a war situation and it's about the most abusive thing that you can do. I mean it strikes right at the heart of the Western, well Western and Eastern economies, so I would have thought there would be crisis measures and quite how that's handled, I don't know.

Well I mean for me to sum up those first four questions, we're almost half way by the way so.

Good.

Then what I would say is I was looking at to see whether any disruption would have a knock on effect that would actually effect the shipping industry and not the Gulf Oil industry, but in a dramatic way and it would seem that if the crisis in the straights was to get too bad, you might end up with as you've just said, a nationalisation of the shipping industry.

Or some sort of…

Some sort of measure that would be that dramatic.

If they were successful and I don't know what it takes to close it off, but if they were, yes.

We're just looking at if really, at the moment.

Yep, yep.

Half way question, if there were to be a present day replay of the tanker war situation during the Iran, Iraq war in the Gulf, how would you expect the tanker industry to react, with specific regard to the insurance premiums, crew human rights issues, that have – human rights has come to the fore just recently, new media coverage and also the reflagging of tankers?

Well I think the first point is that the whole media situation is totally different today. In other words, in the 80's, things went on and they were reported next day or two days later as photographs in the press and maybe a bit of newsreel if you were very lucky. Today the media is more effective, though still getting out into the war zone, at sea not so easy. You know, you need a big helicopter to get out there, it's massively expensive.

Well with the salvage engineers?

And when you, yeah and when you get there, all you see is something burning you know. So maybe yes, but you never know where these things are going to strike and it may well be dead news by the time the salvage engineers get there you know.

So it would be quite a dramatic coverage though wouldn't it, if something did go up?

Yeah, I mean there's a much higher profile – I mean there are still great pictures taken of these ships in the Gulf war. The industry, you know the Gulf war coincided with a period when the end of shipping, the tanker industry was on its knees financially and therefore no one had any money, nobody really paid much attention to the industry, it was just a destitute business and you know people – a lot of the tanker owners during the Gulf war would take their ships, so they just wouldn't insure and the ships, I don't know about the cargos, I think probably the owners may well have insured the cargo, but as it turned out, you know the chances of sinking a ship with the weapons they had then was not that great. I mean [inaudible 27:39] didn't actually do that much damage.

On or above the water line wasn't it mainly?

Yeah, they tended to hone in on the engine or the pump, to the stern of the ship and I think even if they went into the cargo tanks, I don't think it…

No it didn't make…

It exploded the oil that much.

Very few.

So the insurers might be quite, you know quite relaxed about that. There are much more environmental issues today, but if you're in a war situation, I don't know. I mean you know if you pollute the coast of Dubai, well as happened in the 90's in Iraq, I mean Iraq coast and Kuwait, there was enormous, you know when Sudans turned on all the taps and that didn't seem to cause too much hassle. I just don't know what the answer to that is really.

So but in the 80's, some of the shipping companies were running in there without insuring the ships, because they were?

Yeah, I mean the ships were cheap, they weren't worth insuring. I mean if you go in with a 160 million dollar VLCC, I expect or even one re-priced at 80, I expect you would want to insure it now.

Is that because there are more new build tankers now with double hold sort of re-phasing?

It's just the prices are still higher you know. I mean we've had a period of very high prices, so I don't – I think you still have new ships, old ships and on the whole what tended to happen is that the ones that went up the Gulf were the old ones, so they'd pick up the ships and people like Trudos would pick up these ships for three, four million dollars, trade them at the Gulf, take their chances and then they scrapped them when the market got back to…

Yeah. Do you have anything to say on the issues with crewing, that may have changed over the years?

Well crewing – I mean people are more aware of the crewing issue, there is probably slightly more of a shortage of crews, whether that would affect the willingness. I mean I suppose you'd have to pay them a bit more, I just don't know. I don't see an obvious issue.

Issue with that?

I don't quite see how that one would go. I mean if you're going to send your ship up uninsured, perhaps people today would be much less willing to do it and probably you'd get more whistle blowers you know, if indeed that's an issue. Going into port without insurance, it's a port issue really, I mean the amazing thing – I think possibly you would find in today's environment that there's so many more inspections and things, that you couldn't do it, because the charterers wouldn't simply not accept an uninsured tanker, unless they were desperate. So if there was a shortage and nobody would go up the Gulf, then they'll take anything.

It would be a [inaudible 30:59]?

Yeah.

And finally the reflagging the tankers, could you see a situation where tankers would be possibly reflagged?

Well it's an old tradition, you reflag under the American flag, as they did in the 80's. I mean hopefully you get covered by convoys there. Yeah to some extent it might happen.

Okay and this is a rather technical question, but I would still appreciate your view on it please? In your opinion, would a double hold tanker be more resilient to bomb damage than a single hold tanker?

Well in principal, I mean double hold tankers have done well in low impact groundings basically. That's where they're at the best, because you breach the outer skin, you don't breach the inner skin. Anything which – so really if ironically, if you breach both skins, you're worse off with a double hold, because the level of the [inaudible 32:11] is higher on a double skin tanker, so the oil will flow out, more oil will flow out with the double skin tanker, which has a higher [inaudible 32:23] because of the – in other words you know to compensate for – because oil has a specific gravity close to one, if you have a single skin tanker, you're going to have a very low [inaudible 32:37] because you're loading – the ship is full of oil. If you have a double skin with a lot of air inside, you have to low it higher, load it higher and that means that when you, if you pierce both skins, you're going to lose more oil.

So I think the answer is that if you have a slight collision, if you have a hold, but not – it only holds, it doesn't hold the cargo tanks, it only makes a hold in the outer tank, then you're going to gain definitely with your double hold tanker, because you've got no outflow of oil. If in fact you actually make a hold in both of your tanks, then you're going to be worse off with a double hold tanker.

Okay.

Or with a, yeah.

And why do you think the terrorists have not targeted oil tankers more frequently than has been the case?

As opposed to – yeah there's a novel about this isn't there? It was a [inaudible 33:45] did you read that novel? There's a novel about someone who hijacks a VLCC. I think it's by Wilbur Smith actually, it's quite a good book.

Oh right I thought you were going to say that it was – if it's been, yeah well it might be interesting.

Yeah it's a good book, it was written in the sort of late 70's, I think it was also a million ton tanker that got high jacked. Well I don't know, I suppose it's because there are easier targets you know. I mean I guess if you, you know tankers don't move very far, so you get on board on your tanker, you know so you call somebody up and say we've high jacked your tanker. The Pirates, I mean basically what the Pirates are doing are high jacking tankers.

Okay.

Taking them to port and they ask for a few million dollars and they get it, 18 million dollars in the case of Saudi, that's, I mean that's a terrorist attack. I mean the fact that they don't, that they do it, that they're honest enough to say we want the money for ourselves, not for some cause, is a mere bagatelle.

I was thinking, it was about the Lindbergh as well, that was hit off the coast of Yemen.

Oh yeah.

It didn't begin a sort a flurry of attacks on tankers or?

Well I mean it's you know, it's a bit like sort of chucking a stone at somebody, it's an irritant. I don't quite know what point it made or what good it did, it dropped a bit of oil. I think you know number one, tankers are quite big and quite difficult to damage, number two with all terrorist attacks, it has to be the fear of the threat and I suppose you know to do – you would have to threaten to I suppose take, to beach your tanker somewhere where it would pollute the beaches, but you've got to get there.

Right.

And of course you've got to take it in and you've got to get off. In other words, if you're a bunch of terrorists, you know it is going to be a suicide attack, but there's a very high chance that you will be caught alive, because you know and number three, you know since they don't go very fast, Naval Forces can come and surround you and put helicopters on board and you know it's a little bit – I mean if I was choosing ways to highjack something, a tanker is not a very attractive one you know I'd have thought. I mean I have – your guess is better than mine.

Okay, okay it's just in academic literature there was an awful lot of activity regarding the possibility of tankers being hit, but the reasoning behind it was often done because there was no technical input and no technical insight into how the tanker industry actually works.

Yeah I mean there's – well an even better example of that, of the LNG tankers, which for example they wouldn't even let them into Boston, but in fact you know anybody will tell you that it's very difficult to blow up an LNG tanker, because it doesn't ignite when the gas comes out, it needs to mix – it needs to be blended with Oxygen to blow up.

Yeah, yeah, nearly finished. How important is the security provided by Gulf based U.S Armed Forces to the safe passage of oil in the Gulf?

I really – I don't know the answer to that. I mean there's – if you'd said piracy, you know there's a specific answer to that, in the sense that various states are providing war ships that are patrolling and there are legal problems over what rights those people

have got. I mean I'm – at the moment we're not in a state of war, there isn't a state of threat, so…

Does it help though that the fifth fleet are there in Bahrain? Do you think to yourself oh good, that's sort of covered, we don't need to worry about that in the short term?

I think probably one of the – I always felt myself that there was an unspoken agenda with all of the stuff in Iraq and everything else, was that it gives you a foothold in this very, very strategically important area and it gives you a reason to be there and because I can't think of any other reason for doing it and that I always thought that possibly that was the hidden agenda behind the invasion of Iraq.

But if that was true and I don't know if it is, then by the same token, keeping a fleet – you know some sort of sea forces out there is important.

In a roundabout way, do you ever think that the ease by which tankers do go in and out of the Gulf, has contributed towards that instability within the oil producing states?

You mean if you couldn't get the oil out by sea?

Yeah there would be either an alternative or they would adapt to something new? They way that they live their lives or?

Well I think as you've said, the amount of – I mean piracy has been very substantial, but outside of the piracy, the amount of terrorism against merchant ships has been fairly modest, as far as I can remember. I can't think of hardly any examples actually and all I can think is that given your fair point, that this is something that you might very well have expected, then probably the explanation is a practical one, that's when terrorist sit down and think of targets, they look at ships and they think well you know where does this get us? You know if you're flying around over the east coast USA with 300 civilians on board, you've got – you know you're going to make a massive statement. If you highjack a tanker with a crew of 30, mostly from you know third world

states, who don't even know they're there and you know you've got to – you know what sort of threat have you got? You're not going to – I mean killing people isn't a very – if you want to kill 30 people , you might as well shoot them or blow them up in the streets. If you want to pollute the oceans, then of course you can do that, but you've got to manoeuvre your tanker into a position to do that and then you've got to get away you know? It's – you know I don't – it's not a very elegant way of committing harry carry you know?

Going back to what you said earlier, not with reference to Abu Dhabi, but to what extent of coos, political violence, revolutions among and within Gulf oil producing states and changes of heads of State, affected the tanker industry? I mean have these happened and the tanker industry, just carried on regardless, it's not really had much of a…?

No, I think you know the tanker industry is not a very old industry, I mean it really hardly existed in the 30's and it didn't become a significant part of the world economy until globalisation in the 50's and so I think that the – and during that time we've had a pendulum swinging from a position where it was predominantly driven by the oil companies. I mean 80% of the business was owned and controlled by the oil companies, to a position where today 20% is owned and controlled by the oil companies and that pendulum swings back and forwards, depending on strategic factors and so forth and so I've forgotten what the question was now.

The question was to what extent of coos, political violence, revolutions, what would happen?

Yeah I mean so…

In the Gulf area really?

I think probably the oil industry, now that it's reached a large and mature state, the oil industry for the most part is of the view that you leave the risk of these very expensive assets to these independent investors, who seem to always build plenty of them, there's hardly ever a shortage.

Okay.

And you rely on the market place to provide the transport and of course that leaves you sometimes vulnerable to anything which curtails supply in some way and some sort of political crisis could do that and has done frequently and ship owners have made money during the crisis, but it's never lost it all.

Okay, so it's actually to some extent, these things have been beneficial to the industry, as regarding…

Generally the…

As opposed to being disruptive to it?

Yeah I mean the sort of, you know the rule of thumb in the industry is that you do well out of wars at least initially, just because it disrupts things and when things get disrupted, you know tanker owners find they're going to the wrong place, they're hanging around, there's congestion, there's storage, all of these things.

If you don't mind me asking, would you call the straights of [inaudible 44:17] a checkpoint?

Well the US Navy certainly does.

But does the shipping industry class something that's 42 miles wide a checkpoint?

Well I mean the straights of [inaudible 44:29] you know there's a number of these sort of difficult straights. I mean to be quite honest, the English Channel. I mean the English Channel is not that much different from the straights of [inaudible 44:41]. I seem to remember I – in fact it's even less than 14 miles isn't it?

Well the Channel is, but I think the [inaudible 44:52] is 42 miles.

The Channel and both you know the English Channel, you can't take the biggest tankers through fully loaded.

Right.

So I would have thought that you know that in this case you're…

The Channel is, but [inaudible 45:08], I mean has it ever been, has it ever got choked up, if you want to put it that way? When there hasn't been a war…

No, not that I've, not that I'm aware of. I mean I'm not sure – you see it's a small enough area to [inaudible 45:25]. This comes back to the fact of you know closing the [inaudible 45:28] canal is one thing, closing the straights of [inaudible 45:32], you know to all tankers because you might stick a couple of big ones in the middle of the Channel, but small ones can go round the side. I just don't know anything at all about – I've never navigated through there, but on the face of this, you know blocking a seaway 40 miles wide is – you know you can do it with mines, but then people put out minesweepers and you know there's quite a lot of minesweeping capacity…

Yeah, a huge undertaking basically?

Mmm?

It's an unprecedented undertaking really?

Yeah I mean I don't know how you'd do it. That would be the trick really wouldn't it, would be to find the way to do that?

That's enough.

Good, okay.

Sorry, just of that question, what impact on the tanker industry are the Chinese having in the Gulf?

My impression is that the Chinese Government is very, very sensitive about energy policy. It's most important issue that they feel rather uncomfortable with the Gulf and hence have tried to diversify their oil supplies as much as they can, so they have pipelines from Kazakhstan, they have all this investment in Angola, they have you know sort of this ongoing relationship with the rations, which is sort of you know not, it comes and goes, but they keep trying. So I think basically the Chinese use the Gulf, would prefer on the whole to be not too dependent.

Okay, this is my last question, it's probably going to be a – I think I know what the answer is going to be already. Saudi Arabia often has difficulty in acting international law, because international law must first be converted to Sharia Law. Have you ever come across a situation where the issue of Sharia Law has impacted on operations?

I have no idea. You [inaudible 47:44] secretary, Elema, she's doing a course in Sharia Law, a degree in Sharia Law at the moment, so she could probably tell you.

But you've never come across anything where it's happened?

Well of course, well the absolutely number one rule in shipping is that – I mean in shipping there's 180 maritime states and there are some where you really, if you say have a [inaudible 48:11] over a ship and you want to arrest it, there are some states where you would never go and Saudi is absolutely one that you would never arrest a ship in Saudi Arabia. If you could avoid it, you know there are a number of friendly states where you can enforce your rights, but in Saudi, it is very difficult.

What would be a very brief – what would happen as a result of arresting a ship in Saudi?

Well you…

You would just get caught up in the…

Well there isn't – because all of the process of enforcing a mortgage involves taking it to a court, which recognises the sort of legal system used by the banking industry, which is mostly British, a derivative of British Maritime Law and that's what most of the flag states use and you would have to have a regime that could, that would enforce that and as I understand it, you know a Saudi court wouldn't enforce it.

It would be very difficult, yeah.

And so you'd, your ship would sit there and sit there and I don't know what would happen. That's not true, in Dubai for example it's less problematic, still problematic, but definitely I can tell you that you know Saudi is the one that's always given of, you know if you're going to arrest a ship, the first thing you say if you're know in default on a loan is – the first thing you do is check out where the ship is as quickly as you can and make sure you get it into a jurisdiction where you've got some sort of legal control and Saudi is usually the example that's given of one of the countries where you want to avoid if possible.

Okay, thanks. Is there anything you'd like to add on this sort of topic area, that you think might be relevant?

No, I would like to know a bit more – you said why would I worry, did I worry about this? Well I suppose I didn't, because it seems a bit like high jacking super tankers, it's something you could do, but it's a very clumsy thing.

Yeah, sounds better than it actually is?

Well 40 miles, if you find out a neat way to do it.

Well I think mainly the discussion is between Iranian political parties you see, who keep saying we will close the straights. It's not actually something that's done to – with actually any feeling that it's going to actually physically happen, it's just it's sparring amongst the Iranians.

Well and I think you know if you did it too effectively, then you know you put the Gulf at enormous risk.

You put yourself at enormous risk I think really, because you – it's almost like discovering an alternative to oil really.

Well they of course would – well I think you know it seems to me that we're getting down this road I don't – whatever happens I think you know oil demand, we have to take a difficult step to move away from the – you know we've had energy on tap, because it's quite interesting at the moment I'm just doing up a farmhouse, which doesn't have gas and it is a completely different world, from which we are technically unprepared. I mean I go home, turn up the thermostat, all the house gets warm within half an hour. You try to put in place say a wood fire heating system, it costs four times as much, you've got to keep 50 tonnes of wood handy, it doesn't – it will heat in the morning, but it's far more complex and people don't understand it. So I think we need to go down and the answer like so many things is that you don't try to replicate the – the conclusion I came to is it's a great mistake to try and replicate a gas – I mean for a gas heating system, you just stick in one boiler, you heat the whole house, what I've done is I've split it into three different heat sources and put in an integrated system that uses all of them and you will probably never use the – you know you just keep a sort of emergency Christmas day capability to heat the whole house. But in reality, you work on the assumption you never do heat the whole house at the same time. You know you heat downstairs when you're downstairs, you heat upstairs in the evening and you just, but you need the controls to do that and I think these are whole areas of both awareness and technology, which aren't there. I mean practical technology isn't there, you know it's all sort of geeky stuff, you know you go to sort of enthusiasts running things out of a garage in Devonshire.

Yeah and we have enough of those. Well thanks very much.

You're welcome.

Thank you very much.

Field Trip Report

Introduction

On 14-16 November 2008 I attended the first Saudi Arabia Oil and Gas Exhibition (SAOGE) in Dammam, KSA. My aim was to interview company representatives about their views on the recent arrival of China as a supplier of goods and services to Aramco.

My aim was to collect reliable data from industry experts on the subject of Chinese oil industry technology during recorded interviews. In the report below is listed the methodology I adopted to make contact with prospective interviewees, my approach for information, ethical considerations and a detailed list of the questions I asked during interview. The results of the data are analysed and presented in a summary table. As discussed earlier the full extent of the data is displayed later in Chapter 6.

Methodology

I expected to collect qualitative data. I also wanted to collect data from a wide range of service providers from Small/Medium Enterprises (SME) to large global industries. My aim was to secure interviews with representatives (reps) and record their comments.

Contact

The SAOGE Exhibition was scheduled to start on November 15th 2008. I planned to attend on November 14th as this was stated as being a 'setting up day' during which company reps were receiving samples display equipment, literature and constructing their stands. Reps and delegates were also mingling with each other and my impression was that among this 'group' there was a great deal of familiarity and previous contact among one another. I used this informal setting to select potential interviewees and explain my motives.

Approaching potential interviewees

My hopes at interviewing a Chinese service provider were halted when a spokesman politely but firmly refused my approach. When I turned to Aramco a spokesman for the company described Aramco as 'an Ocean' out of which I would never get an answer. However the spokesman kindly introduced me to the Operations Manager (OM) of a key Aramco oil field service provider. (OM) agreed to an interview but only on condition of anonymity and that the conversation was not recorded. These two conflicting developments could be seen as disappointing although I did feel that the data would benefit from the input of willing but anonymous interviewees with a vested interest in participating. I was careful thereafter to select companies from Europe and the US that had English speaking reps who were keen to assist me in recording their views and opinions.

I orientated around the Exhibition and marked off potential companies to approach on the Floor Plan in the SAOGE program. During this process my aim was to choose a range of products and services that could potentially be challenged by Chinese technology. I was assisted in my choices by my own knowledge and experience earned during previous employment as an engineer. For this reason I was able to exclude display stands that offered services such as customs clearance, transport, accommodation and wholesale distributors. Instead I concentrated on companies that manufactured and marketed their own products or services. I was also aware that my own knowledge allowed me to discuss technical issues at some depth which gave reps room to discuss their product more deeply as opposed to explain rudimentary processes.

My initial orientation provided fortunate opportunities where I engaged in conversation with various reps and delegates. During these conversations I generally received a very positive response as the subject of Chinese technology was a contentious topic among established industry providers. Reps were eager to discuss their views and many added that the SAOGE was an excellent place to gather information. In comparison to other bigger oil and gas exhibitions with over 1,000 companies trading, SAOGE only had 207 display stands. This was partly due to SAOGE being Saudi's first exhibition and secondly because the logistics of visa's, personnel and shipping

equipment is fraught with difficulties. Reps informed me that only manufacturers already established in KSA were attending the exhibition. After digesting this information I felt secure in that any data I gathered would come from a reliable source.

I was further supported by the fact that I was not buying or selling a product. In general the reps appeared impressed that my academic studies extended to the future security of their goods and services. In turn I felt that the reps business ethic viewed me as non-threatening and impartial to their views and opinions. My informal chats often moved away from China and on to other relative topics such as Health and Safety, navigating foreign bureaucracies and the safety of ex-pat workers in hostile environments. There were occasions during my conversations when a Chinese rep or delegate would blatantly photograph items on the display stand of the rep I was talking to without the photographer introducing them self. This left me in a decidedly auspicious position where the astonished rep commented on the photographers 'cheek' which appeared to only re-enforce my request for an interview.

Securing an interview

Once I had completed a list of potential companies to interview I produced a strategy to request an interview. The strategy consisted of the following points

1. My identity
2. My associate university
3. The qualification I am studying for
4. The subject of my enquiry
5. Ethical issues

I approached reps on stands towards the close of the day when they were not engaged in conversation or attending to organizational duties. In some cases the rep had approached me during earlier conversations to approach them in order to arrange an interview. At this point I presented the rep my business card and explained the subject and scope of my enquiry. As discussed earlier I chose the reps that had a vested interest in the subject of Chinese technology as it potentially challenged their own

products. I was fortunate therefore that the subject matter was not viewed as a fringe or inconsequential aspect of their business.

Ethical issues

The issue of ethics did present a problem that was overcome by anonymity. It became apparent, due to the 'sensitive nature' of the questions I proposed to ask that if I were to have a frank discussion on the subject any interviewees would have to remain anonymous. The 'sensitive nature' encompassed the identity of the reps position in the company, details of their product and the reps comments about Chinese technology being attributed to their employer. I was fortunate however in that the reps who agreed to an interview wished to voice their opinion about China's entrance to the market so anonymity afforded them the ability to speak. As reps their opinion was that they could not be seen to 'comment on behalf of their company' or be held to comments that could have a negative impact on their business in the future. I had approached a number of reps and not all of them had a negative view of Chinese technology so my instinct was that the interview data would project a balanced view on the topic.

Conducting the interviews

I arranged to conduct five recorded interviews with small, medium and large service providers whose identity would remain anonymous. I was aware that the scope of my questioning would have to take into account the technical content of the reps subject area which may fade in respect to wider geopolitical issues. I decided to structure the interviews with specific questions that would produce data relative to my enquiry and 'open' questions that would allow the interviewee to offer a personal and often more philosophical response. The list of questions below is representative of a typical interview and includes sections on Chinese products, Chinese partners and the geopolitics of oil field technology.

Introduction

1. *Could you tell me please what product you market?*

2. *Where does the expertise in your product lie?*

3. *Does it also rely on the quality of the materials that make the product?*

4. *Could I ask roughly what percentage of your business is in Saudi Arabia?*

5. *Could you tell me please what product you market?*

6. *Is there an intellectual property right issue with those?*

7. *Where does the expertise in your product lie?*

8. *Does it also rely on the quality of the materials that make the product?*

9. *Could I ask roughly what percentage of your business is in Saudi Arabia?*

Chinese products

10. *Are you aware of any Chinese copies of your product being made?*

11. *Do you think that Chinese manufacturers can produce the right grade of steel to manufacture a product at a competitive price at the moment?*

12. *Do you think that may change in the future?*

13. *Do you think it would help Chinese quality control, if they were to work side-by-side with large European and American manufacturers?*

14. *Do the Chinese respect intellectual property right, copyright?*

15. *Do you consider that to be a cultural issue within China or something that they are using it to their advantage to gain more market share? Is the Chinese government turning a blind eye?*

16. *So something that would aid your own, the furthering of your own company and its product would be a tidying of regulations regarding copyright?*

Chinese partners

17. *Would you ever sell any of your equipment directly to the Chinese?*

18. *So will you go into partnership with a Chinese company?*

19. *Are you monitoring how other companies who have gone into partnership with Chinese are performing?*

20. *To your knowledge are some people having mixed experiences?*

21. *Is there any particular previous case or case study that you can think of that sums up your own thoughts on doing business with China?*

22. *What would, in your opinion, have been the difference in cost between buying a copy and buying the real thing?*

23. *Do you think you will be able to survive without involving yourself with the Chinese market?*

24. *Do you think that one of the strengths of your company is that you have longstanding ties and relationships with customers in Saudi Arabia?*

The geopolitics of oil field technology

25. *Did China's entry to the market happen after 9/11?*

26. *And do you think that if you decided to take an isolationist's stance where you decided that you wanted nothing to do with China, given that China are involved in the international oil industry …*

27. *Is an isolationist policy towards China wise?*

28. *Do you think it may be beneficial in the long run if Chinese manufacturers worked with large, like Schlumberger, Halliburton and whether large companies who have the margins would be able to accommodate the training of Chinese managers?*

29. *It's been put to me at the exhibition that if a product could be made in China cheaper than it could be made in the UK that's acceptable to do so, what do you think the UK will lose if this expertise is taken out of the UK?*

30. *And there is within the press a lot of resentment towards Saudi Arabia, having worked here yourself, do you feel that there is conflict between people who work in the oil industry and the general population within Saudi Arabia?*

31. *Do you think it might have been more beneficial if the factories were actually built in Saudi Arabia to be used by, to be staffed by China and the States rather than moving into China, do you think there's a need to bring the Saudi nationals into the oil industry in a larger, greater way than they are at the moment?*

32. *If I was to look at the amount of work and investment that's going on in Saudi Arabia and oil at the moment, would I be misconceived to say that there is so much technology and there's so much investment in new technology that it's because the fields are actually depleting and that there is more technology needed to get remaining oil out more economically?*

33. *And within the oil industry is such a stoppage or such a blow-out or accident, is it ever equated to a similar disruption that could have been caused say by a terrorist or is it classed as something that happens within the manufacturing*

process, the production process? It causes the same disruption but by a different means?

Once the five interviews were completed I was able to introduce 'overall perspective' to the subject by interviewing the Operations Manager (OM) mentioned earlier. 'OM' procured goods and services for Aramco and as such viewed China in both positive and negative lights. I was able to discuss my results with OM about the impact of China on the industry as a whole as opposed to the impact on the reps individual companies.

Results

I conducted five in depth interviews with representatives A, B, C, D and E. Reps A to D were all employed by US or European based Small/Medium Enterprises (SME). A summary of their answers can be found in tabulated form in table (fig 3.2). As discussed earlier in this chapter the full extent of the data in the table is presented later in Chapter 6.

	Common questions												
Interviewees	Percentage of business in Saudi Arabia	Product expertise	Are your Intellectual Property (IP) rights important?	Do you feel the Chinese respect IP?	Reliance of quality of raw materials	Could the Chinese match the quality of your product?	Are you aware of any Chinese copies of your product?	If not, will the Chinese be able to in the near future?	Would you sell your product directly to the Chinese?	Are you monitoring joint ventures with Western/ Chinese companies?	Will joint ventures improve Chinese quality control?	Will your company enter into a joint venture with a Chinese company?	Will your company survive without entering the Chinese market?
A (SME) UK	10%	Design and operability	Yes	No and the Chinese government turn a blind eye to it	Yes	Currently no	No	Possibly	No	Yes	Yes	Possibly in the future	Yes
B (SME) Denmark	small	design	Yes	No, and it appears to be 'official policy' to transfer technology	Quality of machine tools	Eventually	Some parts	Eventually	No	Yes	Yes	Only under strictly controlled conditions	Yes
C (SME) US	30-40%	Operational and intelligence (geological) issues	Yes	Yes, the Chinese need more regulation and self-policing	n/a	Yes as a straight copy	No	Yes	No	Yes	Yes	Only under certain circumstances	Yes
D(SME) UK	15%	Design	Yes	No. They ignore copyright issues	Quality of machine tools	Some Chinese companies are trying to	Yes. We've seen our own drawings in Chinese factories	Yes	Yes	Yes	Only on low end technologies	Yes	The company is currently working with the Chinese
E (Global) USA	Varies	Fabrication	Yes	The company is aware of the IP issues concerning China	Yes. Raw steel	Yes	No	Chinese are manufacturing our products	Yes	The company has a joint venture in China	The company controls the Chinese quality control to western standards	The company has a manufacturing base in China	The company is surviving in partnership with the Chinese

Analysis

The field trip achieved the expected key objectives. I felt I was conducting my enquiry to the right people, at the right time and in the right place. The quality of the data gathered during the field trip was very high. The SAOGE Exhibition was the first occasion where individual suppliers were able to market their products to Aramco as opposed to Aramco approaching the supplier. This environment provided a great deal of choice among suppliers for me to approach for interviews. The suppliers themselves were particularly open to my subject matter as the introduction of China into the oil field service sector was met by a degree of emotions ranging from scepticism to opportunity. The SME suppliers tended to view China as a threat to the long-term future of their product due to China's flagrant breach of copyright. This view changed among larger suppliers who saw China as a prospective partner, all be it a partner that would have to adhere to stricter quality control standards. Due to the nature of the industry it is understandable that reps wished to remain anonymous. I was reminded that regardless of a reps opinion their employer could choose to involve China in their business in the future.

The reps I interviewed all held advanced technical knowledge of their product. Many of the reps were also former oil industry engineers which gave me the opportunity to discuss the safety of ex-pat employees. Due to the geographic location of the world's oil reserves they were used to working in hostile environmental and social conditions. When asked about conditions in Saudi Arabia reps tended not to discuss political issues but instead compared the level of danger to threats they had encountered elsewhere. The general consensus was that the reps employer decided where and when it was safe to work. The final word being that the majority of the world's oil companies are state owned concerns so a supplier merely offered a contract service as opposed to a stake in the venture. In this situation the safety of the individual came before the contract. The exhibition therefore provided me with unexpected additional data.

Conclusion

The SAOGE Exhibition was an excellent choice of venue to collect quality data. It would be very difficult to reciprocate the amount of choice and freely available knowledge available in any other setting. The only concession I had to make was to assure the anonymity of the reps I interviewed. I was assisted in my aims by the fact that I was gathering data that was of interest to the industry in general and on a topic that I did not hold a pre conceived bias.

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