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Using Social Scientific Methodological Approaches to Reducing Risk: How the Risk Reduction Approach Works with Oil and Gas Faculties

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ABSTRACT *The global oil and gas industry is one key target for terrorists with impacts from attacks creating social problems for many societies that produce and use these energy products. This paper offers a methodology by which the risks of terrorism for this industrial segment can be articulated within an organizational context. Identifying the types of attacks that may transpire, the various motives for these attacks and conceptualizing strategies that allow the industry to address the risks of attacks moves the security onus from government to industry, a move that the authors believe is warranted and necessary*

Keywords: Risk reduction, oil & gas industry, terrorist attack

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Introduction

Oil and gas facilities include production fields/sites, transportation mechanisms for the movement of the raw product, refining and processing centers, and ultimately the distribution network components that direct the final product to market (Adams 2003). Risks of terrorism exist at all four levels of this 'cradle to grave' cycle (Cordesman and Al-Rodhan 2006; Yetiv 2004). Systematically analyzing the terrorism related risks for this 'cycle' typically involves the use of expert systems designed to align security for these real world components to the risk of terrorism attacks (Willis, Morral, Kelly and Medby 2005).

In many contemporary cases the risk is from new, emerging, or alternative terrorist tactics (Forest and Sousa 2006; Perry 2001). They may also be risks from slightly modified attack strategies than have been historically understood. These event risks may significantly impact world energy markets and are hidden by traditional risk analysis techniques which may focus on known strategies used by terrorists in the past. The use of a structured form of social-scientific inspired 'possibility analyses' may enlighten security and industry personal as to potential risks previously unrecognizable or obscured by such traditional risk analysis techniques.

This paper presents possibility analysis techniques for the oil and gas industry, a process this paper refers to as risk reduction. This process can allow security professionals to systematically identify and mitigate human initiated event risks before they substantially impact critical oil and gas industry operations like production, transport, refining/processing and/or the final delivery of the product.

Oil and Gas Cradle to Grave Risks

The oil and gas industry is comprised of a complex social system of interrelated parts, subsystems, processes and accompanying vulnerabilities. The risk of terrorism exists at all levels in the production cycle, from the site where extraction of the raw materials is accomplished on through the various means needed to refine this raw material into usable industrial and consumer products. This risk also extends into the distribution networks that deliver the final products to their end market. Terrorism is an enterprise risk for the industry and, like other utilities and industrial sectors, it is one risk that demands systematic approaches to identify, define, and mitigate (Leggio 2006; Shell 2005). We contend that terrorism is a global social problem that likewise demands systematic social-scientific analysis.

In many cases the various steps in the cradle to grave cycle noted above involve volatile, flammable and/or toxic materials that pose a significant human health and safety hazard. These materials have a unique vulnerability profile because of these particular characteristics and because the processes of extraction, refining and delivery of the products are subject to accidents, equipment failure, human error and any number of variables that introduce risk into an evaluation (Shell 2005). In short, all of the components of the production cycle in this industry are inherently dangerous, some subject to explosions during normal operations, and each step in the cycle is vulnerable to the introduction of additional risks from outside social forces.

In addition to the inherent dangers of finding, extracting, transporting and refining volatile industrial materials, the risks that can be introduced into this system by unusual events like terrorism are considerable (Forest and Sousa 2006). The totality of the production cycle is subject to terrorism, sabotage and other human introduced risk. These risks are classified in this paper as human initiated event risks and include terrorism, sabotage, and other like social events that are manmade, not inherent to the production process.

Tied closely to these risks is the fact that the industry has a unique risk profile in world commodities markets that can be manipulated by inherent events and by human initiated events that are not part of the normal risk of production (Shell 2005). A terrorism attack (or as is increasingly the norm - multiple attacks) on this industry almost instantly changes world energy markets and this event risk presents industry security officials with the added responsibility of protecting not just the infrastructure but the overall health and welfare of whole economies (Kalicki and Goldwyn 2005). Economic dislocations resulting from such attacks are a social problem and one that requires a social response.

Oil and gas security and safety professionals must plan for what many consider the unknowable – terrorism – if they are to meet their normal and extraordinary obligations to this industry (Ness 2006). These security and safety professionals have knowledge relevant to this important task, but in some cases the imagination necessary to face new and emerging tactics is lost in the day to day work of securing the safe operation of the industries assets. They are tasked with the critical simultaneous jobs of maintaining industrial goodwill, protecting its physical infrastructure and securing its human capital - the people necessary to run such complex systems. They also have a social obligation to prevent environmental degradation, large scale economic dislocations and other social problems that can arise from attacks.

Terrorism is a multi-faceted hydra, one that is both traditional in its everyday manifestations and one that must be accepted as dynamic in its future applications. The traditional manifestations of terrorism include the well known tactics like bombings, assault, arson, kidnapping, hostage taking, and armed attacks (Threat Reduction Limited 2007). Newer modifications to these traditional tactics include suicide attacks, improvised explosive devices (IED) and explosive formed projectiles (EFP). As previously noted the risk of a single attack is no longer the norm: we must anticipate multiple attacks and in some cases the use of secondary devices designed to inflict maximum emergency responder casualties. One interesting tactic that bridges the historical and the contemporary is piracy or ship based attacks that have been around for millennia. Contemporary manifestations of piracy provide new and emerging risks to the oil and gas industry components heavily dependent on certain related transportation means.

Confronting this Reality

How then can the oil industry plan for the seemingly unknowable terrorist attack? The following section will introduce a structured methodology to identify future risks of such attacks, assess their potential impacts and plan for seemingly ever increasing risk for the oil and gas industry – a process that will attempt to engage the "long view" of the industry and its future prospects, challenges and opportunities to mitigate risks (Schwartz 1991).

What follows is a triangulated social scientific based methodology system entitled risk reduction, a system designed to identify risks, assess their future impact on the oil and gas industry and in the process mitigates the most demanding of the challenges these represent. After an introduction the first phase of this methodology is coupled with a means to use the data generated to develop a capability to envision future worst case scenarios that can enlighten the oil industry on their social responsibilities and obligations.

Risk Reduction Process

The first task is to forecast risks and match that knowledge to the real world of the industry. While no one methodology will ever be free of deficiencies or limitations, the use of multiple methods to identify and define relevant future risks will increase the overall robustness of the analysis process and mitigate the inherent limitations any one method may embody. Typically in social science this is referred to as triangulation of methodologies (Ballard 2000), albeit ones that have been altered to fit the risk of terrorism and this industry. The risk reduction process advocated in this paper has three interrelated sub-processes including the well known Futures Wheel forecasting techniques, but adding in a process of Collective Scenario development, and finalizing with a modified Day After mitigation process. The relationships between these three methods can be visualized as follows:

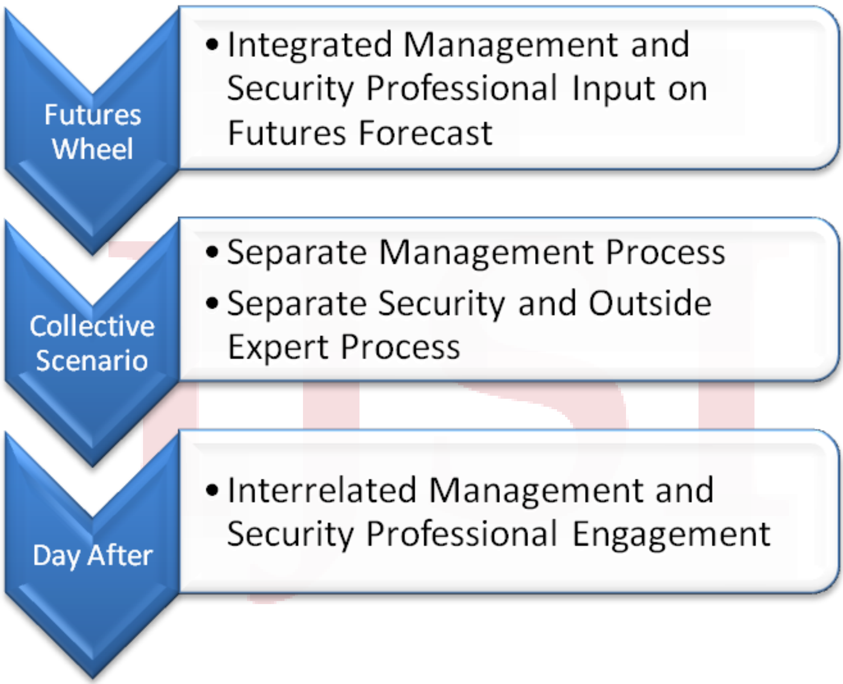

Table 1: Risk Reduction Process

The risk reduction process begins with a forecast of future risks and uncertainties facing the industry. Forecasting is an art but one that with a little understanding can be engaged in by all levels of management. It is important to know that forecasting techniques can be classified as quantitative, qualitative or mixed (Glenn and Gordon 1999).

Quantitative models rest on numerical data and typically require sophisticated computer modeling to accomplish. Overall this type of technique would provide more reliable measures (reliability being defined here as replicable). They would be less stringent on validity (generally described as a measure of the fit to the desired object of interest).

These methods are offered in contrast to qualitative techniques which rely more on expert judgments and hence may not satisfy those seeking more scientific explanations and high degrees of replication for verification of findings. The techniques do have a higher degree of validity, while they are generally thought lower in reliability. Those forecasting methods that mix the two – quantitative and qualitative – would offer the best of both methods – reliability and validity - and generally in methodological circles such mixed measures also represent a degree of triangulation (Ballard 2000).

Forecasts can simultaneously provide normative, exploratory, or combined results (Glenn and Gordon 1999). Normative, also known as goal-oriented or teleological, forecasting is based on the assumption that future needs have an effect on the subject under study. For example growth in energy consumption in the future will change how we discuss risk in the present day. Exploratory or ontological forecasting looks at the pressures of the market as drivers for understanding the future.

Combining the best qualities of these various options for forecasting the future seems easy at first blush but in fact is a more difficult task in practice. This may be best understood when one considers that forecasting methods are semi-complete. Some do one forecasting aspect very well and other techniques do other aspects equally as well. Additionally, some techniques are not directly applicable to the oil and gas industry and/or require data that is not readily available about such a complex organizational system, one of its many and varied sub-systems, or even a large multination corporation with diverse business practices that operates in this industry.

As previously noted, the social scientific answer to such complexity is to triangulate methods to achieve the best mix of techniques, quantitative and qualitative, perhaps even both normative and exploratory, and with recognition of what will work in forecasting the oil and gas industry risks from terrorism. The following chart offers some of the many alternative forecasting techniques available in an effort to assess their usefulness. This chart also is intended to provide the reader with some sense of the complexity one faces when trying to choose the "best" way to define the "worst case" they may face in the future.

An examination and selective choices from among these forecasting options are not the only consideration. As cautioned, some of these techniques will lend themselves to oil and gas risk analysis and others will not so readily adapt to this particular social environment. The risk reduction process uses the Futures Wheel as a starting point for oil and gas related analysis. Thereafter the risk reduction process uses a combination of other methods which were selected from the plethora of ways to take the data provided in the Futures Wheel and apply it to real world applications. The follow on methods were selected based on expert opinions, the unique needs of the industry and the need to integrate security professional perspectives with those of upper management (Fannin 2005). While the choices used in this process may overlap somewhat in orientation, they cover such dissimilar domains of knowledge that taken together they will provide a comprehensive picture of the overall risk profile – a triangulated perspective of the future that can be useful.

Forecasting Technique	Quantitative	Qualitative	Normative	Exploratory
Agent Modeling		x		x
Casual Layered Analysis		x		x
Cross-impact Analysis	x			x
Decision Modeling	x			x
Delphi Techniques		x	x	
Econometrics/Statistical Modeling	x			x
Environmental Scanning		x		x
Field Anomaly Relaxation		x		x
Futures Wheel		x	x	x
Genius Forecasting, Vision and Intuition		x	x	x
Interactive Scenarios		x	x	x
Multiple Perspectives		x	x	x
Participatory Methods		x	x	
Relevance Trees/Morphological		x	x	
Road Mapping		x	x	x
Scenarios	x	x	x	x
Simulation-gaming		x		x
State of the Future Index	x	x	x	x
Structural Analysis	x	x		x
Systems Modeling	x			x
Technological Sequence Analysis		x	x	
Text Mining		x	x	x
Trend Analysis	x			x

Table 2: Forecasting Matrix, Source:Glenn & Gordon (1999)

Phase One – Forecasting the Future

The Future Wheel process was developed by Jerome Glenn in 1971. It has been widely used since then on any number of real world social applications (Glenn and Gordon 1999). The wheel is a way of organizing thinking and questioning about the future––a kind of structured brainstorming on the risks that a society, industry or social organization will face. This process is normally engaged in by strategic management or the executive level. In this instance we argue that security professionals (advanced line management), outside experts (academics, modelers, etc.), technologists (especially those that have a future orientation) be included in the process. Other stakeholders may also be incorporated, in the case of the oil and gas industry this group could be extensive – politicians, government officials, etc.

To begin this technique, the whole group is typically brought together in real time and the name of a trend or event is recorded in the middle of a piece of paper (wall chart, overhead, etc.). Once the trend/event is identified small spokes are drawn wheel-like from the center. Primary impacts or consequences are identified at the end of each spoke based on group member feedback. Next, the secondary impacts are identified for each primary impact in order to form a secondary ring of the wheel. This visualization of a ripple effect is useful in understanding complex social interrelationships of critical aspects of the trend/event under consideration. The use of diverse group members helps insure that the process represents different social aspects of the threats.

The Futures Wheel process provides a useful picture of the implications of the event or trend in a clear, concise and visual manner. This process can help accomplish various purposes. The wheel is most commonly used to:

1. Think through possible social impacts of current trends or potential future events;
2. Organize thoughts about future social events or trends;
3. Create forecasts within alternative futures;
4. Show complex social interrelationships;
5. Display alternative futures;
6. Develop multi-concepts relative to one subject/topic;
7. Nurture a futures-conscious perspective in participants;
8. Aid in group brainstorming useful for scenario development.

The wheel is one of the most commonly used methods among futurists, because it is an effective way to engage thinking about alternative future events. Used correctly, it is easy to use the wheel to think through the implications of, and organize thoughts about, possible future social events or trends. This methodology is flexible enough for use in advanced situations as well as in elementary applications. In short, it can be used by everyday safety and security professionals and by high level management. We posit its use by both levels of management herein as a means to bind the project to decision processes and to gain strategic buy-in for what follows.

The following chart offers one simple example relative to the oil/gas industry and its risk profile. Risk here is defined as the threats, vulnerabilities and consequences of an attack based on a traditional Rand Corporation formulation of risk profiles for terrorism (Willis et al 2005).

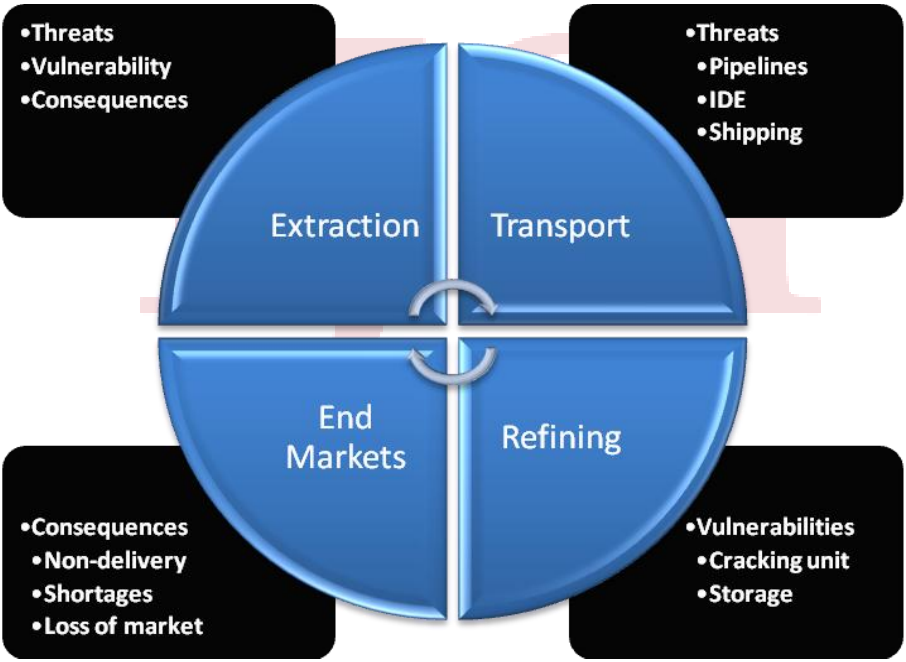

Table 3: Futures Wheel Risk Analysis Example

Typically the Future Wheel method is not used in isolation; generally the results feed into other analysis systems. For example after identifying trends or possible future events, it would be necessary to ask questions like:

1. "If this particular event occurs, then what happens next"
2. "What variables and events necessarily go with this social event or trend?"
3. "What are the social impacts or consequences in total for this contingency?"

To assist in taking the outcomes of this methodological process to the next logical level, we suggest the use of a process of collective scenario development which in turn feeds into systematic policy guidance and risk mitigation processes. The concluding Day After analytical paradigm allows the real world use of the answers generated by these processes and furthermore seeks to find present day solutions for the risks it identifies, an analytical mitigation exercise.

Phase Two - Collective Scenario Development

Identification of risks is the first step but what is done thereafter to mitigate those risks and to institutionalize the process of identification of risk is just as critical. One means to accomplish this task is to conduct simultaneous scenario development brainstorming using multiple groups – in this case we suggest two groups - strategic management and security professionals – groups that would typically have very different perspectives on risk and the threats posed to the industry.

Such scenario development processes have been used in a variety of industrial settings and for similar purposes (Nuzzo 2006; Bible et al. 2006; Busenberg 1999). One major contributing area for this type of study is the nuclear industry, both commercial power plant protection and weapons security, collectively known as physical security (Johnson 2004; Lubenau and Strom 2003). Some researchers in the oil and gas industry have begun to advocate for the use of this technique (Van Hinte et al. 2007; Moore et al. 2007).

Both of the newly constituted scenario development groups would be instructed in the process and benefits of adversarial vulnerability assessment (Bitzer and Johnson 2007). These group instructions would include setting an objective(s) for the group based on the outcomes noted in the Futures Wheel process described above. Ground rules for the participants would be communicated next. After these foundational activities are complete both teams would be asked to generate ideas about how the risks and threats noted in Phase One could play out in the real world. To finalize the process each group is asked to select ideas that represent the most challenging risks and threats they can envision. The process can be visualized as follows:

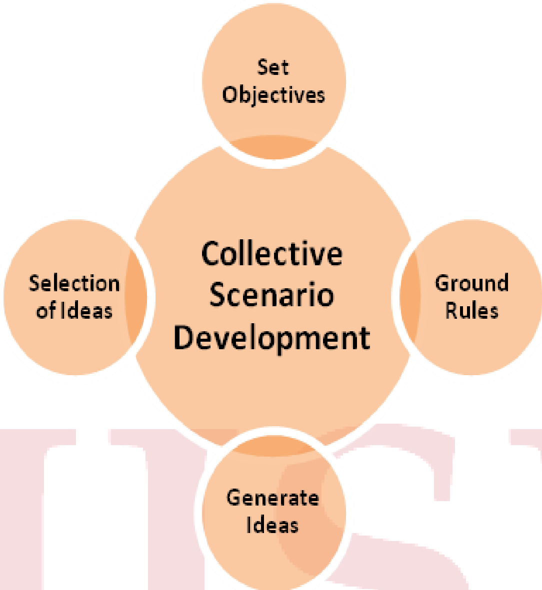

Table 4: Collective Scenario Development Process

The suggestions generated from the two groups in this process, as well as the discarded ideas generated, would be given to a special master – a referee team who would guide the transition into the next phase of the risk reduction process: The Day After simulations.

Phase Three - Day After Simulations

Once the above process has helped determine a variety of alternative threats, vulnerabilities, and hypothesized consequences, the scenarios that these alternatives represent need to be vetted and used to stimulate change. One way to address these possibilities is the use of "day after" simulation methods (the mitigation hybrid of the Scenarios techniques). This particular methodology was developed by the Rand Corporation (2007) to understand terrorism and its consequences (one of its current uses).

The day after process begins with a listing of detailed contingencies set in the future (typically five years hence) and in this case that were derived from the above processes. Once the referee team has combed through the data produced by the teams in Phase One and Two, these experts develop contingencies for the simulations to follow. The contingencies are organized into a longitudinal chronology that represents the contingencies the industry would face on its hypothesized worst day.

Strategic managers and operations personnel are gathered together once again for these last set of discussions. Integrated upper management and selected operations personnel groups are created, a balance of both in each working group being optimal. These groups may be augmented with members of the special master team and as necessary with additional stakeholders.

When a typical five year future time period is posited, detailed contingencies are given to selected participants to the simulations. In the contingencies a range of worse case characteristics are addressed. For example, during the morning session of a day long process the participants would be given a series of incidents that transpire over a length of time. Some of these would be false leads, others much more socially impactful. In total the social impact of these events would create a worst case scenario that will be unexpected. This worst day would be outside of the norm of the participants experience and challenge them with its complexity and equally as important it should challenge the participants to address the consequences.

Ultimately the study participants would be asked to find real world, present day solutions for the future problems found in the overall analysis. For example, they would be asked in their opening afternoon session to provide solutions to these future problems. They are asked - What can they do now, today, to mitigate the future social effects posited in the simulations? The final part of the day, late afternoon or early evening, would bring the two groups together; ostensibly to debrief their various solutions to the problems posed in this process. The process can be visualized as follows:

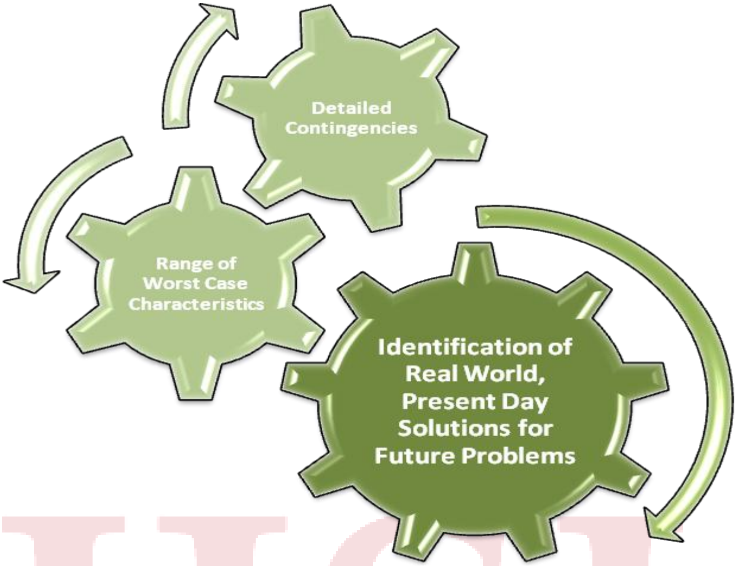

Table 5: Day After Process

The suggested analysis herein would need to be repeated systematically to address changes in variables/contingencies but by using established methods of analysis, the administration of any such a longitudinal planning program would be informed by good social scientific techniques and thus avoid reactive policy decisions detrimental to the social order. Such combined use of accepted social science methodology and expert forecasting techniques would allow oil and gas security planners the opportunity to get beyond the minutia of the everyday and towards more comprehensive planning, something sorely needed in the debate over terrorism attacks and their risks. Considering their need for relative autonomy and the costs of failure to address such needs, the onus for such tasking should be placed on the industry and not on state entities or governments. The social costs and economic benefits of this forecasting effort fall on industry. This would then mean these risks would not necessarily demand governmental interventions like war, social engineering or other large scale responses.

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