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Enterprise Risk Management: Is the Oil and Gas Industry Adequately Handling Exposures to Extreme Risks?

by D. Wood

Enterprise Risk Management: Is the Oil and Gas Industry Adequately Handling Exposures to Extreme Risks?

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Many oil and gas companies have over the past decade, in the wake of tougher corporate regulation, established or expanded risk management procedures and systems integrated with company-wide approaches, or Enterprise Risk Management (ERM). Do such systems necessarily make companies more aware of and better prepared to deal with low likelihood but high impact (extreme risk) events should they occur?

The industry as a whole does not have a very good track record in managing or responding to unexpected risks and opportunities in an integrated and systematic manner. Indeed the ERM frameworks of several large multi-national energy companies and service companies have been found wanting in the past decade when confronted by the impacts of unexpected yet high-impact events, such as: natural disasters, corporate fraud, rogue trading, market collapse, industrial accidents leading to fatalities and widespread environmental contamination, political and fiscal instability leading to asset expropriation, the dissatisfaction of communities and the protests of special interest groups.

This article addresses how ERM frameworks can be developed to strengthen internal controls and accountability, to safeguard the real asset portfolios of large organisations while, at the same time, not losing sight of the complex nature of uncertainty (i.e. risks and opportunities) associated with extreme events. Unfortunately the drive over the past decade by the oil and gas industry to adopt ERM has been led primarily by the financial services sector with a somewhat blinkered corporate governance, compliance and financial risk management mindset. To be effective at safeguarding an organisation's real assets and in improving corporate performance, ERM frameworks need to integrate the many facets of financial, operational, geopolitical, fiscal and strategic risk and opportunity management impacting the real asset portfolio in addition to addressing internal control, governance, reporting and compliance issues.

Several quantitative risk analysis techniques, such as value at risk (VaR), use stochastic methodologies that have been shown (e.g. the Black Swan forecast of Taleb, 2007 and the subsequent collapse of significant financial corporations during the 2008 banking crisis and economic meltdown) to systematically underestimate the complex interactions of multiple and correlated risk exposures and the significance and potentially catastrophic impacts of low probability events should they occur. For good reason many companies are now sceptical of relying too much on such quantitative methods, regardless of the sophistication of their mathematical algorithms, to determine what are and what are not acceptable levels of risk exposure to take.

Low-likelihood but severe-impact events (i.e. extreme risks or catastrophes) are subject to significant levels of uncertainty which are difficult to quantify accurately and notoriously vulnerable to under-estimation by mathematical algorithms. However, failing to appreciate such exposures and developing appropriate contingency plans and emergency response plans can expose organisations

to extreme financial losses and consequential losses associated with reputation damage and limited access to future opportunities (e.g. Deepwater Horizon accident in U.S. Gulf of Mexico of April 2010). Because uncertainty impacts assets and organisations in complex and non-linear ways it helps to adopt rigorous approaches to evaluating uncertainties from both the real asset and corporate perspectives and developing meaningful contingency plans to respond to extreme events.

Many approaches to analysing and categorising risk s (and opportunities) begin with two dimensional risk profiles, maps or matrices. Scenario-based risk assessment can also be aided by such probability versus consequence diagrams (e.g. Wood et al. 2007) identifying different grades of risk exposure and those requiring mitigation actions to reduce exposure. Such diagrams usually involve likelihood of occurrence (frequency or probability) on one axis and severity of impact on the other axis using semi-quantitative scores or fully quantitative probability and impact cost approximations. The diagram shown in Figure 1 shows no scales and is design to illustrate generically some of the risks that oil and gas companies typically are required to manage and how they might be distributed on a probability versus consequence diagram. The nature of the risks includes a wide range of diverse origin, e.g. operational, corporate, market and equipment. Typically mitigation actions are likely to be designed to move specific risk exposures closer towards the origin in Figure 1. Notice that the extreme risk scenarios are located towards the bottom right in Figure 1 and, because they are associated with very low probabilities of occurrence, often fall off the radar screen of day to day risk operational managers who are focused on the more frequently-occurring risk scenarios.

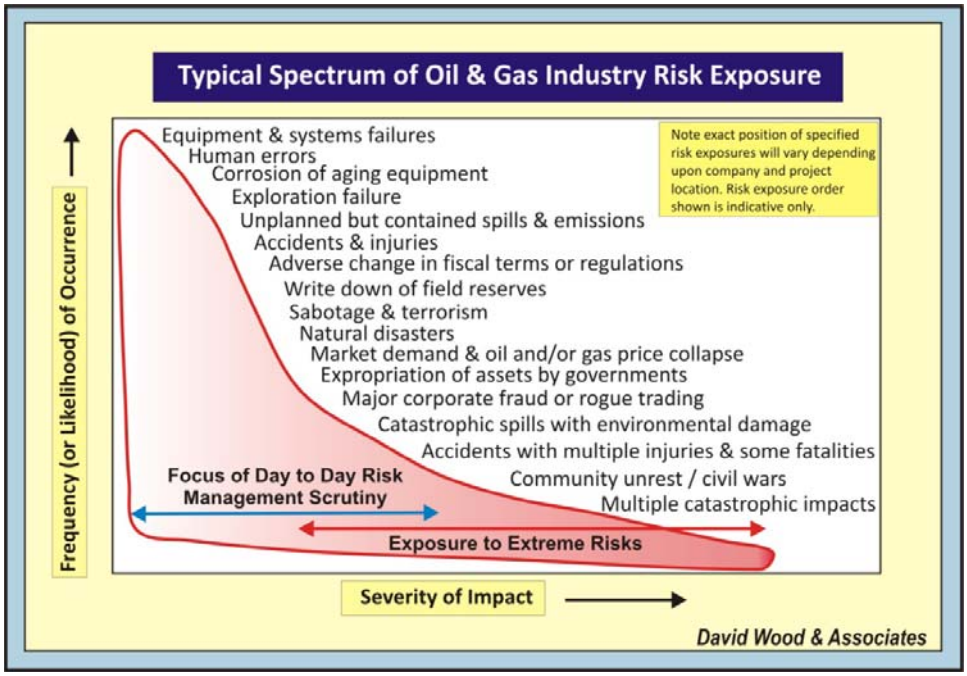

Figure 1. *Spectrum of oil and gas industry risk exposure expressed in two dimensional terms of likelihood versus impact. Extreme risks form the low likelihood / high impact region of the distribution and typically receive a different level of attention than more frequently occurring risks.*

It generally aids analysis and mitigation strategies to use of "bowtie" and/or "butterfly" diagrams (e.g. Wood et al. 2007) that identify the links among events, their causes and potential

consequences/outcomes. Such diagrams help raise awareness that events associated with typical risk scenarios can have multiple outcomes derived from multiple causes.

Real projects and even companies operating portfolios of assets tend to see only a subset of the risk scenarios and exposures described in Figure 1 actually occur or materialise into loss-causing incidents over periods of many years or decades (Figure 2). This can lead some into a false sense of security about their risk exposure, applying the flawed logic that if it has not happened historically we do not need to worry about it. If as organisations we only focus upon the risk scenarios that are most likely to happen, we tend to significantly under-estimate the true level of the risk exposure being carried. In scenario-based risk analysis it is important to include for considerations some or all of the scenarios identified as extreme risks in Figure 1 to develop more robust risk mitigation and response strategies.

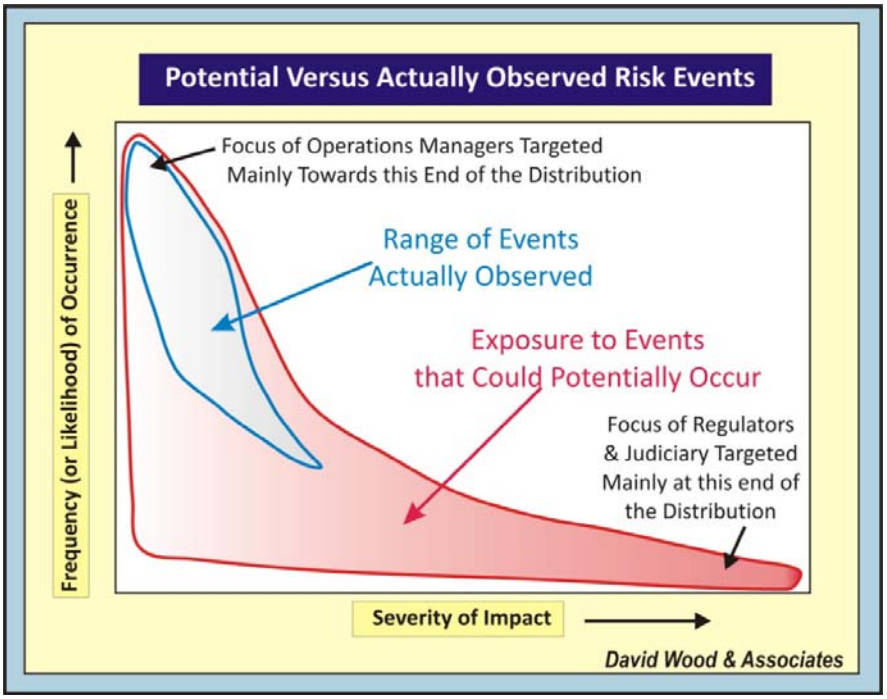

Figure 2. *Risk exposures actively managed by many operating in the industry tend to be a sub-set of a larger spectrum of risk exposure to potential events that could occur, but are deemed highly unlikely to occur. These additional low likelihood / high impact events constitute a spectrum of extreme risks with potentially catastrophic outcomes if they occur.*

Another issue for the risk event scenarios identified in Figures 1 and 2 is that corporate risk managers tend to gain more experience in dealing with and mitigating the more commonly occurring risk scenarios towards the top left end of the distribution. On the other hand industry regulators and the judiciary tend to address issues and problems that arise or pose major threats to the industry towards the bottom-right end of the distribution. Although, the full spectrum of risk scenarios is there for all to analyse, depending on the purpose of the analysis, and the focus of the parties undertaking that analysis, the sub-set of risk scenarios actually receiving most of the attention may be smaller than an independent risk analyst might expect.

In fact the situation is significantly more complex than is illustrated in these two-dimensional diagrams (e.g. Figures 1 and 2). Each risk scenario in fact is multi-dimensional, non-linear with some risk exposures being strongly correlated or dependent upon each other. If we fail to consider some of the other dimensions and limit ourselves to likelihood of occurrence and severity of impact we are again likely to underestimate the true magnitude of our exposure to each scenario. Multi-dimensional analysis of risk exposure can be useful in drawing attention to characteristics of certain risk scenarios. Figure 3 shows a radar diagram plotting six dimensions of risk exposure for an extreme risk scenario on a semi-quantitative analysis scale of zero to ten; where zero means minimum or no exposure and ten reflects maximum exposure. There is no limit to the number of dimensions that might be included in such a multi-dimensional analysis.

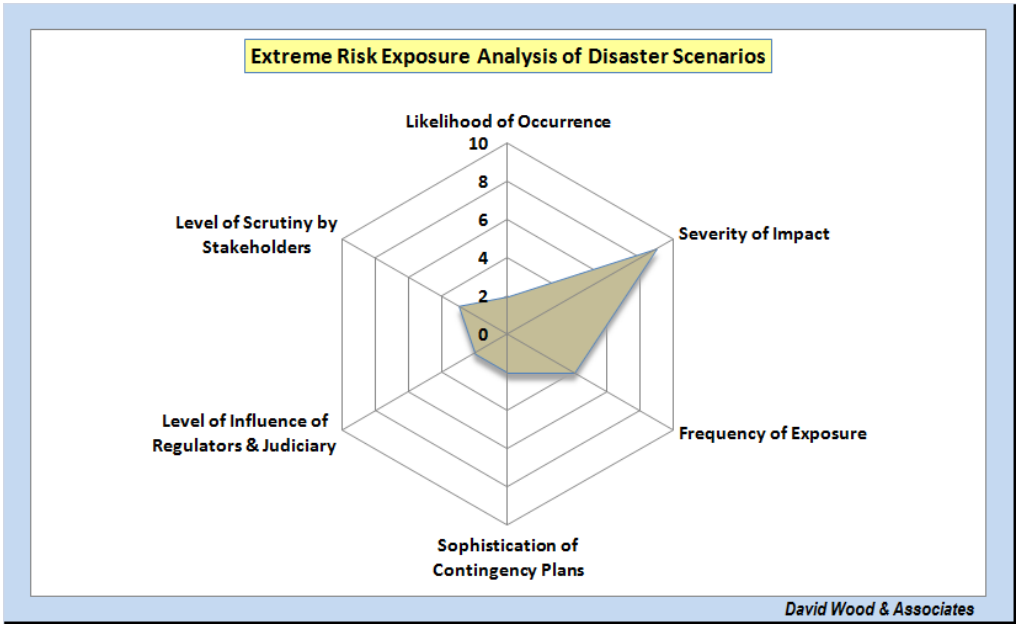

Figure 3. *Extreme risk exposure is a multi-dimensional issue, not the two dimensional problem that is often used to quantify risk exposure. Some of the additional factors to frequency of occurrence and severity of impact that influence the likely outcomes should extreme risk events materialise are shown here. Such multi-dimensional risk profiles help to determine the level of preparedness of an organisation to deal with specific extreme risk scenarios.*

In Figure 3 the four dimensions of the analysis not included in Figures 1 and 2 are:

- ***Frequency of exposure***, which is quite different from likelihood of occurrence. For example a normally unmanned production platform in the Gulf of Mexico is exposed to hurricane damage only during the hurricane season. Risk of loss of life on the platform due to a severe hurricane impacting the platform is limited in its exposure just to the short periods during the hurricane season when maintenance personnel actually visit the platform.
- ***Sophistication of contingency plans*** is often crucial in being able to rapidly respond to and deal with extreme risk scenarios when they materialise. The Macondo well blowout of April 2010 is a poignant example of inadequately developed contingency plans by the industry as a whole. The fact that no deepwater well capping device was available to contain the blowout and deal with a malfunctioning blowout preventer for nearly three months and had

to be manufactured "on-the-hoof" reflects poorly on the industry as a whole. No operating company or service company had considered such a scenario or if they had did not see the need to develop contingency plans to deal with it. The fact that the Marine Well Containment Company (MWCC) was formed after the Macondo blowout event and one year on had grown to 10 member companies (i.e. Chevron, ConocoPhillips, ExxonMobil, Shell, BP, Apache, Anadarko, BHP Billiton, Statoil and Hess) suggests that none of those companies had adequate deepwater well capping contingency plans in place prior to the Macondo blowout. Those 10 companies operated approximately 70 percent of deepwater wells drilled in the Gulf of Mexico between 2007 through 2009. The reason for the lack of contingency plans is perhaps best explained in terms of Figure 2 and the lack of a perceived problem based on historical occurrences.

- ***Level of Influence of regulators and judiciary*** is an important dimension because if there are existing regulations or legal precedents associated with specific risk scenarios then it is more likely that robust risk management options and/or mitigation strategies are already available and have been developed by other industry participants. Greater industry awareness and more rigorous analysis of the multiple causes and multiple impacts of such scenarios are also more likely to exist if these have been previously addressed by regulators, legislators or the judiciary through past incidents, claims or arbitration tribunals.
- ***Level of scrutiny by stakeholders*** in a real asset also often determines the level attention an operator is likely to dedicate to a particular extreme risk scenario. Even if an operator's assessments of the level of risk exposure to a particular extreme risk scenario are very low, if an internal or external stakeholder raises concerns about exposure to that event then it is likely that the operator will dedicate more resources to mitigating that risk or developing robust contingency plans to respond should it materialise. Such actions by the operator are likely to help satisfy the concerned stakeholder (e.g. a community concerned about contamination of its water resources).

It is also often helpful in risk analysis to distinguish uncertainties into "pure risks" and "speculative risks", an approach used for many years by sectors of the insurance industry. Pure risk involves only a possibility of loss or no loss—there is no possibility of gain. They are often associated in the oil and gas industry with safety, security and environmental hazards impacting individuals, communities and property. Pure risk can be categorized for insurance purposes as personal, property, or legal risk and, up to limits of cover and exclusions for gross negligence, their impacts can generally be insured against.

On the other hand, speculative risk differs from pure risks in that they involve the possibility of profit or a loss (i.e. risk and opportunity). This characterizes most financial investments made by oil and gas companies. Most speculative risks are uninsurable, because they are undertaken willingly in the expectation (or hope at least) of profitable outcomes (i.e. seeking to exploit the associated opportunities while mitigating the risks involving loss). Organisations being prepared to take speculative risks are, of course, essential for the economic development and growth of societies and communities, employment and the development of new and innovative technologies. Hence it is crucial that organisations develop risk management strategies and frameworks that address not just minimising the hazards of their exposure to pure risks, but also maximising the benefits (financial

and non-financial) from speculative risks while avoiding the potential losses or adverse and diverse consequences of failure.

Integrating enterprise risk management (ERM) frameworks and triple bottom line (3BL) analysis techniques (i.e., profit, people and planet originally proposed by Elkington, 1997) into risk analysis and investment decision has potential to enhance performance of speculative risk taking in the oil and gas sector from a society and environmental perspective. Indeed 3BL integrated with ERM should help to justify or refute the basis for taking on extreme risk exposures particularly where some of the multiple impacts of the extreme risk scenarios are concentrated on communities and/or the environment (Figure 4).

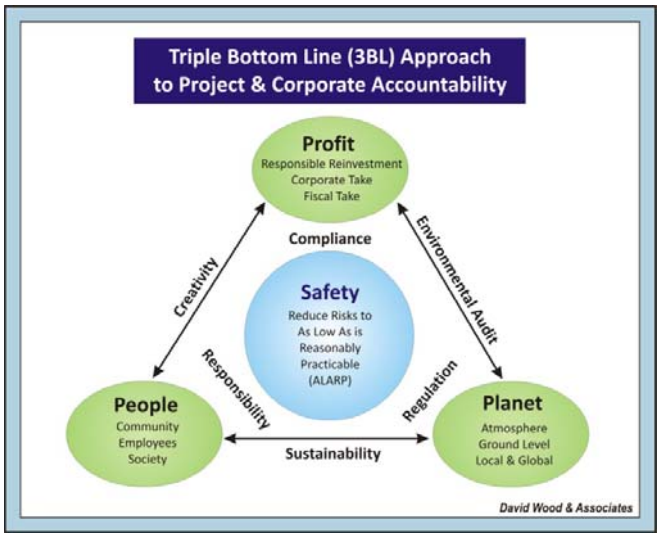

Figure 4. *Triple bottom line (3BL) principles require careful attention to full life cycle benefits and disadvantages of specific projects, i.e. through design, construction and operations and along the full supply chain. The approach also requires addressing a project's long-term impact on the local community (i.e. beyond short-term employment and fiscal benefits). 3BL performance needs to be measured against key performance indicators (KPIs), pre-determined and agreed by consultations with the project stakeholders (not just corporate shareholders).*

The 3BL business case and implications were originally explored in a Elkington's book (1997) called Cannibals With Forks: The Triple Bottom Line of 21st Century Capitalism. Elkington (1999) refined his concepts specifically for the oil and gas industry, making the point that the social justice (i.e. "people") component of 3BL had been largely overlooked to that point by the industry. He also identified then that public demands for sustainability and social justice are not simply issues for the major transnational corporations; increasingly, they will be forced to pass the pressure to focus on these issues on down their supply chains to smaller suppliers and contractors. As Martin Whittaker (1999) pointed out the TBL approach is designed to help oil and gas companies (and companies from other industries) knit the three components of sustainable development-economic prosperity, social equity, and environmental protection-into their core operations and essentially make the jump from sustainability theory into practice.

As highlighted above, shareholders and many managers in operating oil and gas assets often focus more on events with a greater likelihood of occurrence. When extreme events (i.e. rare catastrophes on the downside and giant discoveries on the upside) do occur judicial and government inquiries and arbitrations are more likely to be focused on the outcomes of relatively rare and unusual high impact - low likelihood events. Along with major disasters, giant oil and gas discoveries also often grab the attention of legislators; in the latter case they are usually concerned about appropriate levels of fiscal take, development of indigenous industry, levels of local employment and impacts on the local community. ERM systems on the other hand need to address the full spectrum of events in order to be able to manage day-to day uncertainties and also be in a position to respond credibly to the extreme events.

Following the demise of Enron and in response to external regulation mandated by the U.S. Sarbanes Oxley Act (2002) the Committee of Sponsoring Organizations of the Treadway Commission (COSO) developed the Enterprise Risk Management Integrated Framework in 2004. Many oil and gas companies have subsequently developed ERM systems based upon the COSO and other frameworks. However, the financial risk and compliance mindset with which some companies have implemented these systems led Wood & Randall (2004 & 2005) to question the effectiveness of such systems at managing the full spectrum of real asset risks to which oil and gas companies were exposed.

The global financial crisis in 2008 demonstrated the importance of adequate risk management to all sector of the financial sector. Since that time, new risk management standards have been published, including the international standard, ISO 31000 'Risk management – Principles and guidelines'. In the UK, the Association of Insurance and Risk Managers (AIMIC), the Public Risk Management Association (ALARM) and the Institute of Risk Management (IRM) collaborated (2010) to produce a guide, drawing together the COSO framework and ISO3100 guidelines, in an attempt to provide a structured approach to implementing enterprise risk management (ERM). Unfortunately, these developments since the financial crisis of 2008 and the prolonged instability of global financial markets, which persists in 2011, have reinforced the narrow financial risk and compliance mindset towards implementing ERM that has prevailed over the past decade. In criticism of such a narrow focus of ERM on financial risks and compliance Wood & Randall (2004 & 2005) developed, some time ago, a trapezoidal framework focused on effective ERM Implementation, which is updated and expanded in Figure 5 to address the suggested handling of extreme risks.

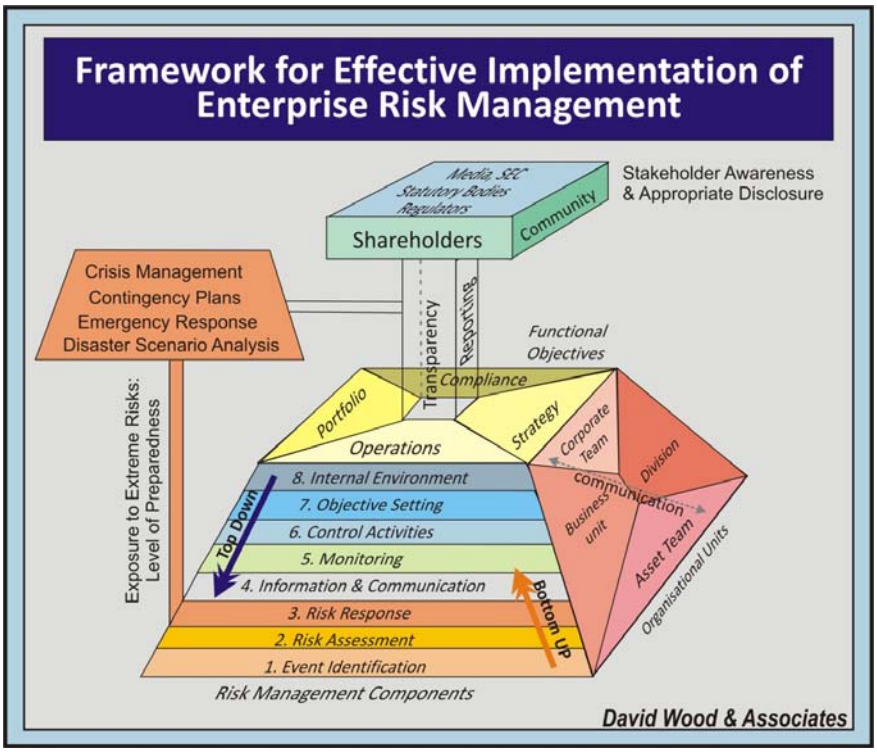

Figure 5. *Enterprise risk management (ERM) framework focused on implementing effective ERM systems by oil and gas companies should include clear requirements to prepare for the handling of extreme risk events if and when they materialise. This should include a level of disclosure to stakeholders sufficient to create confidence that preparations to deal with exposure to extreme risk are robust and fit-for-purpose. The framework further develops the trapezoidal framework proposed by Wood & Randall (2005).*

The ERM framework proposed in Figure 5 has at its core multi-directional communication systems facilitating efficient reporting and documentation of the risk management process. Reporting and transparency also underpin information flow to stakeholders outside the management of the organization, such as shareholders, statutory bodies, communities, and the media—all key to effective compliance and establishing credibility for the ERM system implemented. In relation to management of extreme risks that may never materialise credible and transparent contingency planning is seen as essential. Contingency plans should incorporate robust systems and appropriate allocation of resources to develop effective crisis management centres and emergency response procedures covering a wide range of potential disaster scenarios. Establishing credibility of such contingency plans with a wide range of stakeholders requires a level of transparency and openness that some oil and gas companies are hesitant to embrace. Formation and membership of the Marine Well Containment Company (MWCC), albeit belatedly, by many of the deepwater operating companies is an example of how the public announcement of membership of a collaborative emergency response effort is likely to increase stakeholder confidence that certain risk exposures are being appropriately addressed.

Whatever is done to optimise risk and opportunity performance in an organisation should be clearly disclosed and signposted to at least the Board of Directors (or senior officers) of an organisation, its shareholders and employees, and be apparent to the scrutiny of a judicial inquiry and regulator, if required. To this extent at least, all ERM frameworks employed and information generated by them should be obvious and sensible to all of these different parties. It is always better to focus on forecasting, preventing or exploiting potential extreme events rather than be seen as merely reacting to them when they occur and trying to manage responses to incidents in an ad hoc manner from a control viewpoint. A robust ERM framework incorporating scenario planning for extreme events should enable organisations to be better prepared with contingency plans for such events when they do occur.

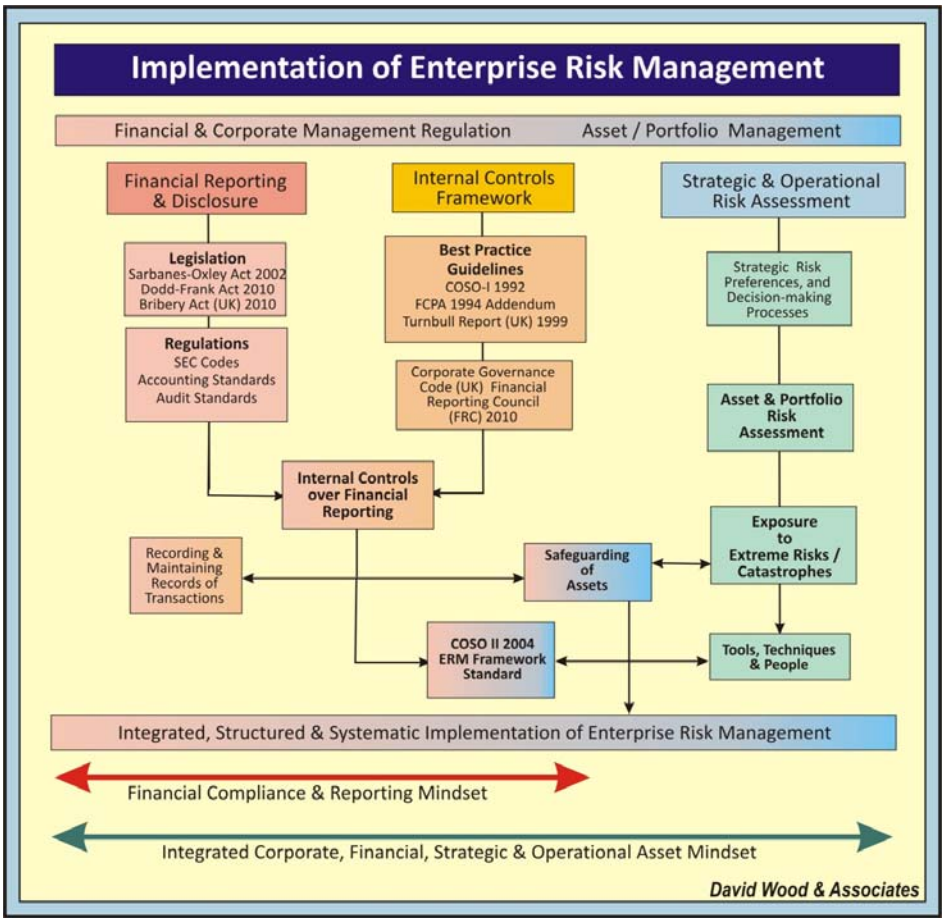

Figure 6. *Effective enterprise risk management (ERM) implementation requires careful attention to legislation, regulation and corporate governance. However, for an operating oil and gas company it also requires an integrated approach focused on its full real asset portfolio not just internal financial controls. To safeguard the assets of an oil and gas companies it is necessary to consider how exposures to extreme risks might impact those assets and the organisation as a whole.*

The key phrase that integrates the financial and operational aspects required for effective ERM is "safeguarding of assets" (Wood & Randall, 2004). Figure 6 illustrates some of the recent legislation, regulation and best practice guidelines that influence how companies organise their internal financial controls and reporting. The recent Dodd-Frank Act (2010) involving changes to financial

regulations in the U.S., and the UK Bribery Act (2010) and U.K. Corporate Governance Code (2010), illustrate how the compliance and corporate governance landscape continuously evolves and place additional requirements on large organisations, including oil and gas companies, to demonstrate that they are modifying their control systems to take these new requirements on board.

Many of these legislative and regulatory changes have significant implications for enterprise risk management and also require ERM frameworks and implemented systems to be updated and expanded. It is easy for companies to become preoccupied with financial controls and corporate governance in this regard. For operating oil and gas companies this is a mistake. In addition to establishing robust internal financial controls oil and gas companies need to focus more specifically on "safeguarding" their real asset portfolio. It is in and among those real assets that many of the exposures to extreme risks lie and need to be addressed with robust contingency planning (e.g. Figure 5). For this reason Figure 6 highlights that implementation of ERM systems requires an integrated corporate, financial, strategic and operational asset mindset rather than a more blinkered compliance and reporting mindset. The real asset portfolio and its exposure to a range of extreme risk scenarios needs to be part of that integrated ERM mindset.

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