The BP Deepwater Horizon Disaster

What is the Cost of Profit?

We know by now that BP and its drilling partners sought to minimize costs and to maximize profits by not planning for the unlikely worst. We also know by now that these practices both allowed the recent oil spill to occur, and prohibited any rapid mitigation. A preventable disaster ballooned into a barely containable cataclysm.

How can reasonable businesspeople and their logical computers have allowed this to happen? Corporations want us to trust that the logical self-interest ruling free enterprise will regulate what they do, so that our government will leave them alone. Trusting in business expertise and resolve, government did not perform its duty to protect life, wealth and the environment. Government did not require, and industry neglected to perfect the "blow-out preventers" (BOPs) that might have contained this disaster.

We have known for a long time that to make long term profit considerations more attractive than maximizing current quarter revenues, there must be changes in the corporate tax structure that favor responsible business practices. There must also be an ethical rebirth of business psychology. We are not sanguine however about the prospects for an ethical rebirth, nor for change based on rational, overall financial self-interest. Instead, we identify the incomplete, risk-management methods that enable terrible decision making, and hope to change them. The Deepwater Horizon blow-out preventer failure is especially galling.

One might still argue that the large costs of this disaster are a worthwhile risk based on odds of occurrence. Huge financial failures such as the turn of the 21st century Long Term Capital Management failure and the housing bubble collapse of 2008 defeat this argument. The miscalculation of risk in the Three Mile Island and Chernobyl events explodes it.

In 1997 and 1998, blow-out preventer testing on 83 deep water wells in the Gulf of Mexico produced 117 failures. The Minerals Management Service commissioned a formal investigation including a "Fault Tree Analysis" of these failures. That report listed possibilities, but left most causes undiagnosed. (http://www.mms.gov/tarprojects/319/319AA.pdf - see its Appendix).

Relying on retrospect, it can be no surprise that the root cause of the failure to prevent the recent blow-out remains unknown. Instead, now nearly five months after the spill began, BP can only provide "Eight Key Findings Related to the Causes of the Accident" (see Appendix below) and acknowledge the failure to prevent blow-out (hidden at the bottom of the list) as probably the most critical. Without reliable knowledge of the cause, prudence required the government to enact a politically damaging drilling moratorium. If root causes were known, a drilling moratorium would likely have been unnecessary.

Practitioners of formal problem solving methods understand the chasm between recognizing "key findings related to the causes" of failure and determining the *root cause* of failure, Sufficiently improbable, so-called Black Swan events simply do not need to be accounted for in the standard method of problem evaluation and decision making. Problem solving whose goal is simply to determine statistical likelihoods of events (i.e., mean-time-between-failures) and cost-benefit analyses neglects causality, which is necessary to understand to implement proper corrective action and reliably to prevent recurrence. As a result of data-drive problem solving, an epic

mass of oil and water emulsion today still threatens the Gulf coast wetlands as it courses unseen through the Gulf of Mexico with unknown consequences.

Does anyone know about the law of cause and effect? It is known as the Second Law of Thermodynamics. The dirty truth of the Second Law is that the most likely outcome of causing anything is more disorder, often called "entropy", than order. In other words, the Second Law predicts that sooner or later, any possible disordering event can happen. Most of us know this as Murphy's Law: whatever can go wrong will.

Oil drilling causes events to happen. Causality is always a roll of the dice, and not a balance of forces. Nasty side effects are always possible. Unfortunately it takes much more energy to reverse an effect than fueled the cause. It takes a lot more energy to un-mix an emulsion of oil and water than to mix it. "Zero-defects" is impossible, but it is possible to grasp that because risks are unknowable, planning for the worst is always necessary. As investor Warren Buffet famously puts it: "Never maximize the upside. Always minimize the downside."

The costs of clean-up and of lost economic opportunities measure the extra entropy unleashed on this occasion. Educated dollar value estimates based on conservative calculations (see Table below) indicate that the Entropy costs for this disaster are more than 1000 times greater than prevention costs. If BP investors' $50 Billion loss of market cap is also included, that ratio increases to 2000 to 1.

Cambridge Energy Research Associates, a leading oil analyst, says that globally, one in every 10 barrels of oil produced in 2030 will come from ultra-deepwater operations. So the opportunities for more devastating blowout events, low probability as any individual occurrence may be, enter the realm of certainty.

It is time to turn away from short term profit-serving, cost-benefit decisions and toward an approach that evaluates cause and effect and the rising costs of inevitably increasing entropy.

We have moved from the Age of Information into the Age of Entropy.

Appendix: Eight Key Findings Related to the Causes of the Accident

(Deepwater Horizon Accident Investigation Report 09/08/10 www.bp.com)

1. The annulus cement barrier did not isolate the hydrocarbons.
2. The shoe track barriers did not isolate the hydrocarbons.
3. The negative-pressure test was accepted although well integrity had not been establish
4. Influx was not recognized until hydrocarbons were in the riser
5. Well control response actions failed to regain control of the well
6. Diversion to the mud gas separator resulted in gas venting onto the rig
7. The fire and gas system did not prevent hydrocarbon ignition
8. The BOP emergency mode did not seal the well

Table: The Cost of BP's Doing It Wrong in the Gulf of Mexico:

Costs of preventing causes vs. costs of rectifying effects.

Item	Cost
Case I: Attacking Causes	
Drill typical deepwater well at $1Million / day, times 50 days	= $50 M
Drill relief wells (Cost adder to lower runaway blowout risk)	= $50 M
Find & fix root cause of BOP failures ($100M amortized over 200 wells)	= $0.5 M
Total cost to do it right (Prevention Costs = $50.5 M)	**= $100 M**
Case II: Treating Effects	
Drill typical deepwater well at $1Million / day times 50 days	= $50 M
Costs to stem gusher at $40M per day (approx. 100 days to containment)	≈ $4,000 M
Cost to clean up and pay claims (Credit Suisse estimate)	≈ $37,000 M
Cost of loss of recreation business and commercial fishery in gulf over 20 years	≈ $10,000 M
Total Costs of getting it wrong	**≈ $51,050 M**

Arthur Jonath and Richard Goldwater, 9/13/10
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