Changing the Dialogue

A Series on the New Business Dynamics

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Rapid Response Management:
Thriving in the New World Order

White Paper

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Scott M. Shemwell, D.B.A.

It is no use saying, 'We are doing our best.' You have got to succeed in doing what is necessary.

- Winston Churchill

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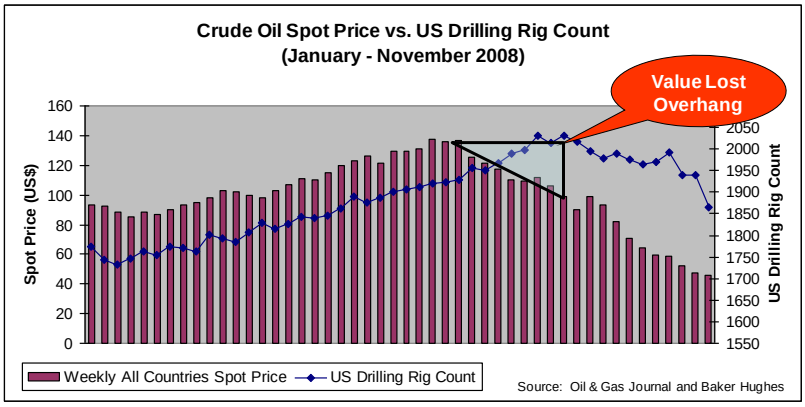
Executive Summary

Who would have predicted the events of the last half of 2008? The rise and dramatic fall of the price of oil and the collapse of the global financial markets, etc.

Well in fact, just such a scenario was simulated on a computer in 2005. The **Oil ShockWave** exercise, hosted by the current Secretary of Defense, Robert Gates, with participants from an august group of former senior governmental officials predicted the events of 2008 through computer simulation or war gaming.



So why were so many caught unguarded, and why did the drilling rig count continue to rise almost two months after the price of oil peaked? No one can predict the future with certainty, but we all *SENSE AND RESPOND* to changes in our environment—some just more quickly and effectively than others. Minimizing **Value Lost Overhang** requires a *rapid response* to changing conditions on the ground.

It should also be noted that the problem is mirrored when growth explodes quickly. In this case, access to key personnel, material, and equipment can be in short supply, such as during hurricane recovery operations.

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The Tipping Point Meets Critical Mass

Malcolm Gladwell described The Tipping Point as a viral geometric growth of an idea that transforms a small relatively unknown thing into possibly a global phenomenon, in a very short period of time—much like the spread of a flu epidemic. Similar to the critical mass construct required for nuclear fusion—the amount of fissile material that allows a self-sustaining chain reaction.

Arriving at the tipping point or achieving critical mass requires energy. Biological energy in the case of a flu epidemic and physical energy in the case of fissile material. The modern global economic engine requires fuel as well. The energy source driving today's markets is the Internet.

The World Wide Web is aptly named. Using this energy source, the geometric growth from an infinitesimal start of the Tipping Point model can be explosive. Quickly hitting

critical mass, societal behavior becomes self-sustaining throughout an increasingly shorter economic cycle.

Future researches may support this hypothesis or not; however, anecdotal evidence suggests that management will be faced with high volatility driven by an increased velocity of information.

If the hypothesis that the economic environment will forever remain more volatile than in the past due to the increased velocity of information, then organizations will have to develop organizational machinery with a much more rapid sense-and-respond mechanism.

The problem is sensing these dynamics in a timely manner so that the organization can adjust to them, sometimes in a predictive manner. What was needed was a tool that would better illuminate organizational environmental structural flexing that often leads to rapid and dramatic change.

Rapid Response Management

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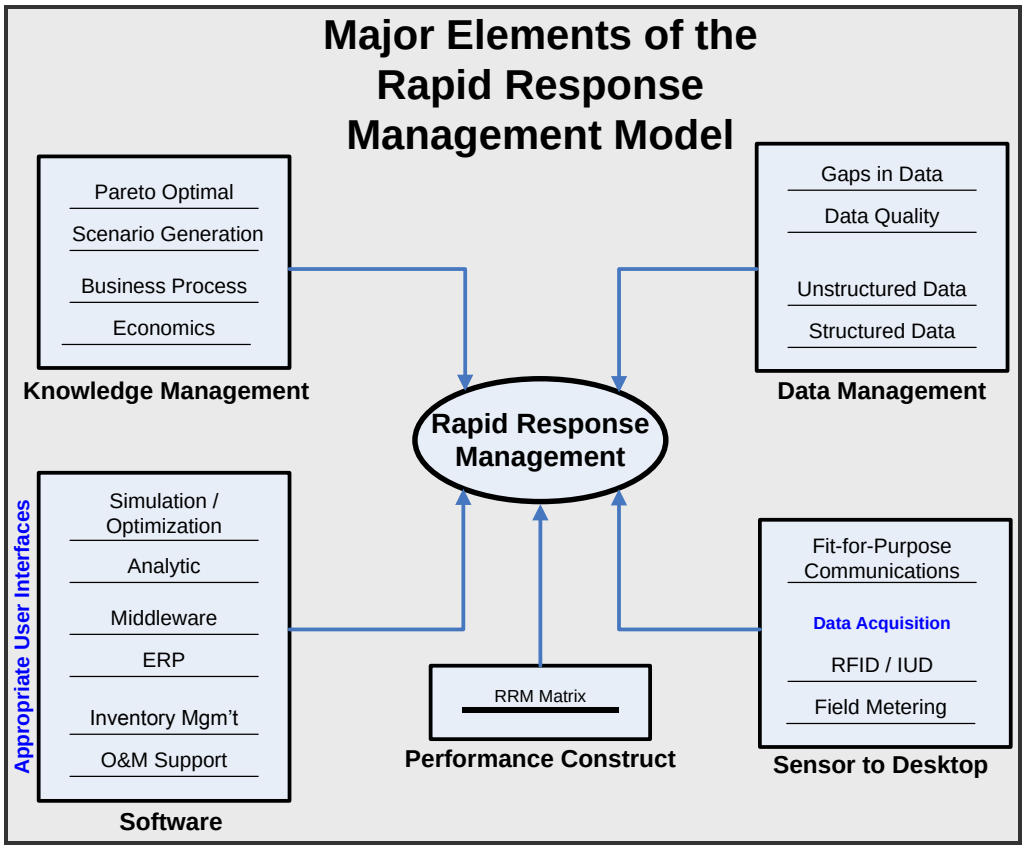
While a Rapid Response Management solution may appear to be complex, even daunting in reality it is really straightforward and readily attainable. The management model is composed of five major sections:

- **Knowledge Management**, or those *SUBJECTIVE* thought processes unique to the human being.
- The **Software** application suite that *EMPOWERS knowledge workers*.
- The **Performance Construct** articulated in the RRM Matrix that determines the LEVEL OF FITNESS and RESPONSIVENESS for any given organization during its life cycle.
- A **Data Management** system designed to enable decision-makers to *NAVIGATE* massive data stores in a straightforward manner.
- A **Sensor to Desktop** system designed to *FEED* process relevant real time data and update management control of decision processes on an ongoing basis.



Numerous organizations already have many of the components of the RRM solution. Therefore, any RRM implementation must take into consideration the current organizational and technical landscape, adapting and integrating as required.

In most cases, the development of an RRM solution DOES NOT involve major software capital expenditures or long running consulting contracts. Straightforward integration into existing processes and information technology architectures is desirable and doable.

Economic Value

RRM is a proven approach. Organizations deploying even components of this solution have enjoyed a return on their investment in excess of 60%. This paper describes five case studies, which for the most part are compilations of projects delivered. These include:

Case Study	Value Derived
• **Process Manufacturing**	Best-in-Class firms in the process manufacturing segment use Analytics, Simulation, and Optimization to drive "What If" scenarios are a fundamental aspect of their business. This approach enables these firms to **remain competitive and profitable** in a low margin, globally competitive sector.
• **Military Operation**	The extensive use of Sense and Respond Inventory Management driven by RFID has *reduced inventory costs* by up to **30%**; *increased equipment availability* up to **15%**, *reduced downtime* up to **10%** and *reduced personnel costs* up to **30%**
• **Oil & Gas Production**	The use of Operations & Maintenance Process Management has dramatically improved in five major categories: Cost Takeout—up to **50%**, Cost Avoidance—up to **50%**, Productivity & Efficiency—up to **8%**, One-time Cash Flow Impact, and Intangible—up to **50%**.
• **Risk Assessment**	The use of process simulation to assess the risk associated with a large drilling program. In one other case, a refinery saved almost **18%** during an upgrade process.
• **Sensor to Desktop**	Integrating older in situ metering with newer metering devices, cost effectively enabled process relevant real time data to be accessed by authorized users. Value included: • Timely, accurate production data capture and availability • Automated manual processes • Enabled remote asset monitoring • Optimized O&M processes • Integrated disparate data sources • Asset visualization symbolically correct • Enhanced measurement accuracy

In today's volatile, global economy, executives must make good decisions quickly. While some may pine for the good old days, the *velocity of information*, or the exchange rate of information, enabled by today's information and communications technologies, has forever changed that landscape.

Rapid Response Management provides executives with the proven tools they need to steer a proper course through these uncharted waters. RRM can be implemented a number of ways, as there is no one-size-fits-all requirement inherent in some methods, but rather a **FIT-FOR-PURPOSE** approach designed to get the organization up to speed rapidly.

In June 2005, a group of nine former White House cabinet members and senior staff participated in a problem simulation exercise headed by Robert M. Gates, then President of Texas A&M University and currently Secretary of Defense. The purpose of the **Oil ShockWave** exercise was to assess various scenarios in a *war gaming* manner.

In Segment 2 of this simulation, the price of oil rose to approximately $120 per barrel, ultimately causing a recession. Specifically, during this exercise gasoline rose to $4.74 per gallon ensuing a reduction in consumer spend for other goods and services and migrating additional US dollars to foreign producers.

Uncertainty lowered consumer confidence resulting in a further reduction of spending. Automobile purchases declined sharply, air travel fell, and monetary policy was potentially impacted, as a function of reactions by the Federal Reserve Board.[i]

But this was only a computer simulation exercise.

In 2008, this computer driven scenario possibility became a real life drama.

Predicting the Future

On January 2, 2008, West Texas Intermediate Crude Oil (WTI) closed at $99.63. On July 11, 2008, WTI closed at $145.66 and on November 20, 2008 its closing price was $49.62.[ii] After a short but emotionally long ride down, the Dow Jones Industrial Average closed down from 11,100.54 on July 11, 2008 to a low of 7,552.29 on November 20, 2008.[iii]

Similarly, during the same period, the Oil & Gas Journal 200 basket closing price dropped from 2406.24 to 1415.57.[iv] Finally, the PHLX Oil Service Sector Index 52 week range varied from 104.42 to 364.26 with a recent close at 127.66.[v]

Impossible to manage and maintain shareholder value and trust in this environment? Difficult yes, but with new tools enabling a *RAPID RESPONSE MANAGEMENT* (RRM) model, executives can effectively mitigate downward slides of this magnitude while assuring analysts and investors that they can capture significant value on the ride up a volatile curve.

While no one can know the future for certain, 21st century organizations will need to be better able to *game* scenarios and prepare accordingly.

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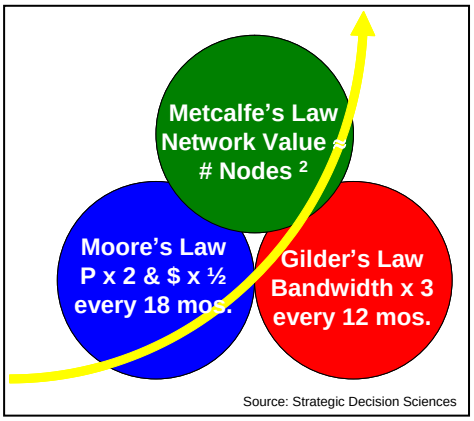
Future researches may support this hypothesis or not; however, anecdotal evidence suggests that management will be faced with high volatility driven by an increased *velocity of information*.[viii] The rate which information is transmitted from one knowledgeable individual to a set of others with similar attributes is accelerating. Moreover, in keeping with Laws of Information, the velocity of information is expected to increase.



This convergence of exponentials; Moore's Law stating that the *number of transistors on a microprocessor doubles every 18 months;* Metcalfe's Law stating *the usefulness of a network equals the square of the number of users*; and Gilder's Law stating *bandwidth rises three times faster than the power of the computer*; unleashes untapped energy that we are just beginning to understand. [ix]

During the presidential campaign beginning in 2003, Howard Dean burst upon the scene capitalizing on the energy of the Internet to get his message across as well as raising significant funds.[x] Republican presidential contender, Ron Paul and the eventual winner Barrack Obama both capitalized on this energy during the 2008 election. Most pundits now believe that campaign fund raising has permanently and structurally changed.

A study earlier this year found that almost half the US population looks to the Internet for news and information rather than television, up from about 40 percent a year before. Not surprisingly younger people, having grown up in the online world, go to this media more than their parents.[xi] Moreover, the success of the social networking web sites and online video will most likely continue to fuel this structural change in how information is received and acted upon.

One can argue that the recent rapid meltdown in global markets might have accelerated due to the velocity in which information was shared across the planet. If this hypothesis is supported, might a similar explosion take place on the upside?

Americans drove 9.6 billion fewer miles in July 2008 than they did in July 2007.[xii] Yet according to the CEO of Marathon Oil Corporation, apparently countering conventional

wisdom that recovery from the current recession would possibly drag into 2010, that demand for gasoline was already coming back.[xiii]

Towards a More Responsive Organization

Fundamentally, the oil and gas business model is one of risk mitigation. Exploration and Production has invested heavily over the past several decades to develop visualization decision support systems that provide better insight in to the geology and the ability of the formation to produce. Contemporary *Earth Models* integrate geophysical, petro-physical, geologic, and reservoir engineering data into robust virtual representations of the unseen subsurface.

Financial models routinely provide management that the Net Present Value (NPV) of a project meet corporate hurdle rates at acceptable risk levels. Oil and gas commodity trading often requires sophisticated modeling of forward looking pricing models.

Supervisory Control and Data Acquisition (SCADA) drive production automation scenarios. Refineries and petrochemical plants have been highly automated for decades and the exploration and production sector has begun to deploy similar technologies, often labeled the digital oilfield.

Moreover, the engineering and energy services firms supporting producers manage their businesses similarly. As the industry workhorses, these firms bear the risks associated with operations and maintenance (O&M) and often assess opportunities based on Return on Capital Employed (ROCE) metrics.

Senior management is often trained in finance and/or engineering and therefore understand the concepts of feedback loops and iterative modeling—concepts inherent to Rapid Response Management. This understanding suggests that in the petroleum segment RRM is aligned with current practices and should add immediate and structural economic value to organizations that embrace it.

Decision Cycle Time Alignment

This section is taken from the author's 2004 ground breaking study ***Roadmap to Enterprise Optimization: A Guide to the Impact of Information Driven Field Operations on the Petroleum Corporation****.*[xiv] *While this document was specifically written to address the economics of the so called digital oilfield, its precepts are applicable to other industries as well.*

The oil and gas industry continues to invest heavily in Real Time Operations (RTO) with more fields coming on line. RTO is particularly useful bringing to bear the full engineering and geo-scientific capability of the firm and its energy service partners. Organizations can now manage well bores, fields and reservoirs more aggressively, effectively, and efficiently than in the recent past.

Field information is transmitted to Enterprise Resource Planning (ERP) systems that include:

- Production Accounting
- Financial Backbone including General Ledger, Accounts Payable/Receivable
- Human Resources

- Asset Management, including forecasting, scheduling, production allocations, etc.
- Supply Chain Management, including procurement and inventory management.

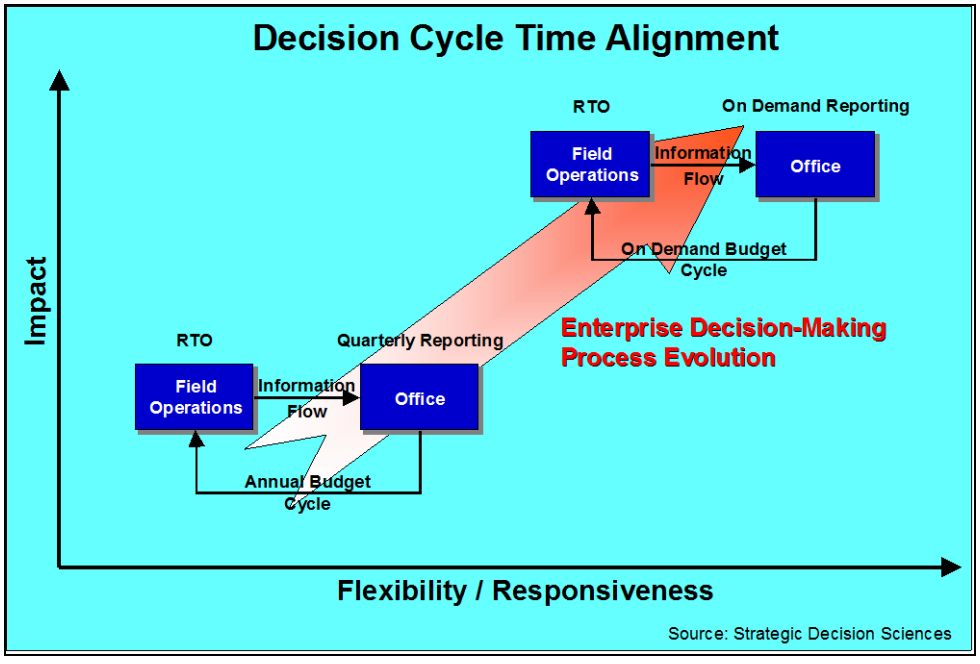
These systems also respond to changes rapidly, increasingly at a cycle time that is appropriate for the task at hand. In many industry sectors, manufacturing has migrated to a **Just-in-Time** scenario that provides management with a great deal of flexibility and ability to respond to changing situations.

Evolving Governance Requirements

Sarbanes-Oxley requirements, increasingly involved shareholders (including institutional holders such as mutual funds), and the Capital Markets are demanding more and better accountability. While publicly traded companies are required to report Quarterly Earnings, there is increasing pressure for the entire organization to make decisions in a more RTO fashion. Compounding the current decision cycle is the persistence of the Annual Budget Planning process.

Quarterly reporting and budgetary processes have their place and will continue to be fundamental to the management of the business and reporting to stakeholders. However, the best, most aggressive and dynamic organizations better align decision cycle times to provide management with the best available information, **On Demand**.

The advent of On Demand reporting and budgetary adjustments that reflect the ability of the organization to maintain end-to-end alignment of its decision-making processes is the near-term end game. Including the alignment of individual and business unit metrics, this configuration is necessary to achieve and maintain optimal enterprise performance, and is critical to operational excellence and the subsequent increase in shareholder value.



Evolution of Managerial Decision-Making

The on demand concept is a best practice for many sectors. Until recently, the upstream sector had several barriers to its entry into this set of business practices, e.g., lack of many of the critical IT and business process components and the ability to integrate them. However, all the technology and business process change capabilities necessary are now available to every firm in the industry.

The advent of Integrated Operations in its full implementation enables this end-to-end decision support solution. Organizations must now determine how they will implement this ability if they are to remain competitive.

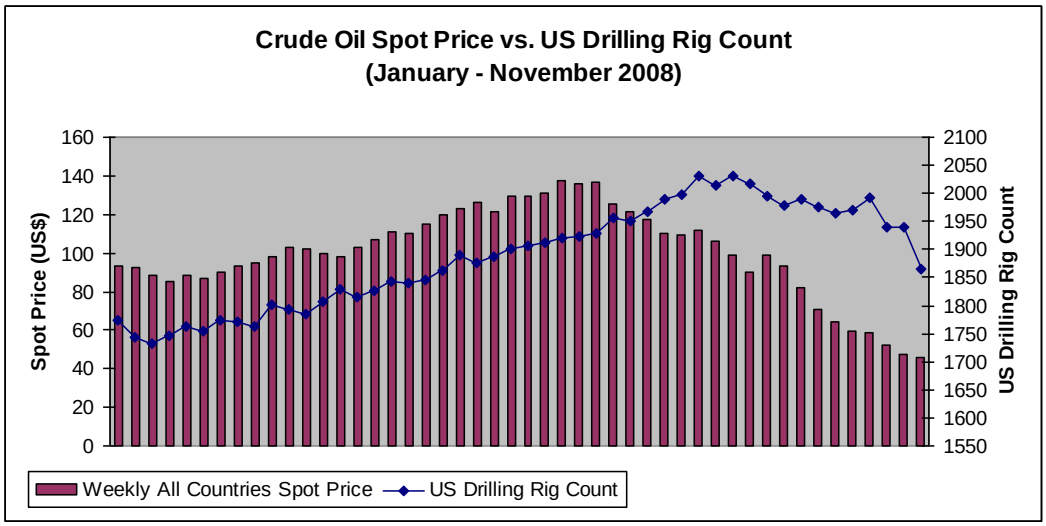
Rapid Response Management

As discussed previously, one good, recent example of the volatility of the current economic environment is to look at the price range of crude oil during the calendar year 2008. According to the Oil & Gas Journal, the Weekly All Countries Spot Price FOB Weighted by Estimated Export Volume (Dollars per Barrel) was US$92.93 on January 4, 2008 rising to a high of US$137.11 on July 4 and closing at US$45.72 on November 28.[xv]

On these same dates, the US Drilling Rig Count was 1774—1921—1866. However, at its height the rig count was 2031 on both August 29 and September 12, after the price of crude oil peaked and closed at US111.83 and US$98.53 respectively—International Rig Count range was similar.[xvi]

The following chart depicts the above crude spot price vs. United States drilling rig count through the end of November 2008. Readers will note that the number of active rigs continued to rise even as the spot price of crude was dramatically falling.

To be sure, work-in-progress, seasonality, and contractual obligations are most likely part of the picture. Mobilizing and demobilizing heavy equipment involved in drilling an oil or gas well requires some time and in certain parts of the world weather patterns limit the time of the year drilling can be done (in this case it is sometimes prudent to continue projects budgeted during weather windows). Finally, especially offshore and major international projects are long-term activities not easily stopped.



However, the data suggests that the level of drilling activity declined following the weakening of the crude oil price point, just as it has for each down cycle throughout the life of the industry. The issue is the lag time between changes in the primary trend, the price of the crude oil commodity, and dependent activities such as drilling.

If the hypothesis that the economic environment will forever remain more volatile than in the past due to the increased velocity of information, then organizations will have to develop organizational machinery with a much more rapid *sense-and-respond* mechanism.

Sense and respond is a managerial framework originally popularized by IBM in the 1990s as a replacement for build and ship model traditionally used by manufacturing. Since its inception, it has grown to include a number of tools enabling a systemic construct toward organizational performance.[xvii]

In the late 1990s the author first posited a construct; Structural Dynamics.[xviii] Organizations often thrash through one reorganization after another seeking to become better attuned to a changing environment. In many cases, each organizational process and/or structural change simply paves the way for the next—sometimes on a quarterly basis.

> *Unless we can develop an understanding of the underlying structure of a process, whether a physical system such as the universe or a behavioral system such as those found in business processes, our ability to architect the correct processes is limited. Therefore, if we are to avoid re-iterative re-engineering, it is important that we develop a basic understanding of underlying structure. We must also keep in mind that structure is not static.*

While change is inevitable and usually for the better, processes surrounding *Change Management* can get clouded. In many cases, employees will simply hunker-down and wait for a superficial change management exercise to pass, so they can get back to business as usual. Frequently, this failure to change is the result of a poor understanding of the actual dynamics at work.

We tend to see structure through a passive lens. Terra firma, buildings, large ships, etc. are all seen by the layman as static objects. In reality, every structure, including biological entities, are actually dynamic.

The problem is sensing these dynamics in a timely manner so that the organization can adjust to them, sometimes in a predictive manner. What was needed was a tool that would better illuminate organizational environmental structural flexing that often leads to rapid and dramatic change.

Structural Dynamics seeks to better understand the underlying current of the dynamic structure in which both physical and behavior systems exist.[xix] Building from a System Dynamics view of behavioral processes, the fundamental premise upon which the theory of *Structural Dynamics* is developed is the belief that structures are not static and that more often than not, these dynamics are NOT directly observable.[xx] Over time, the very nature of the structure and the very nature of the component parts of the structure may be radically different from today's composition. Those individuals, firms, industries, and even societies that are able to recognize and react to structural changes will be the best suited to obtain competitive advantage over their competitors. Those who do not will be disadvantaged.[xxi]

The other dimension of Structural Dynamics is the micro-component. Significant movement in industry structure is usually not the result of a major measurable event. Like the geophysical plate tectonic movement, structural change is essentially the integral calculus (the integration of the sum total) of a large number, perhaps infinite culmination of events. This process is what makes changes in structure so difficult to discern, much less understand until after the fact.[xxii]

The Structural Dynamics algorithm uses Structural Equation Modeling (SME), a multivariate statistical technique--a more powerful extension of other methods. Structural equations are appropriate when several theoretical constructs underlie the dependent variables such as one finds in complex situational process; when basic measurements tend to be unreliable individually; when the researcher knows *a priori* the theoretical relationships among the dependent variables; and when sample sizes are unequal across. Moreover, the structural equation technique, while addressing the testing of hypotheses using traditional methods, is a more robust statistical technique and takes into account measurement error and restrictive assumptions of homogeneity.[xxiii]

One major benefit from using SME is that *latent variables* can be treated in the models that are developed. A latent variable is one that cannot be measured directly, but is hypothesized to underlie the observed variables.[xxiv] This is a very powerful tool when assessing complex situational driven environments that today's executives face.

Executives are challenged to understand the implications of structural changes in their industry segments prior to their competitors. One component often overlooked is the Industry Change Trajectory inherent to a specific industry.[xxv] Due to cultural and market differences, it should not be surprising that diverse industries react to the environment in different fashions. Structural Dynamics can incorporate these variances in its models, thereby, specifically incorporating this *soft* variable.

Scenario Management

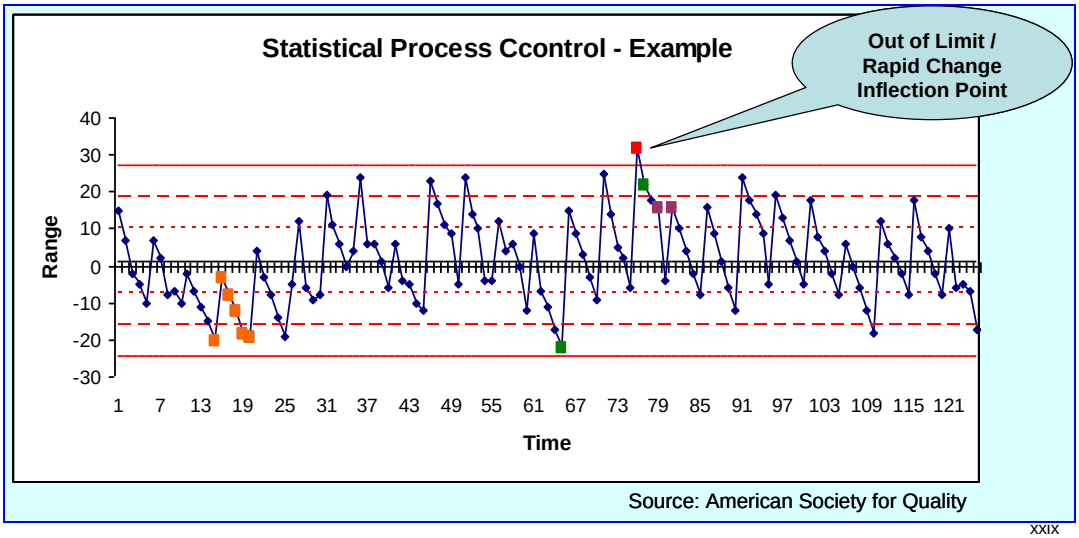
Common sense and good judgment are more critical in today's global, hypercompetitive environment than ever.[xxvi] Moreover, understanding complex dynamic organizational systems requires different managerial tools than traditionally used.[xxvii]

Structural Dynamics provides management with a systemic view of the organization and its environment. This understanding, coupled with process simulation and optimization provides the basis for a sound decision support system tuned to meet the needs in an environment that requires rapid, sound, informed decision making.

Fast Loop Control

Likened to video games with their immediate and consequential feedback, process simulations must be tuned to exogenous environmental changes.[xxviii] Production and manufacturing engineers routinely manage processes using similar tools.

Controlling a real time process requires constant intervention. As long as the process remains within a specified range, small tweaks are all that is required to assure optimal performance. However, when the inflection point of the curve changes dramatically, either up or down, greater intervention may be warranted. In the example below, the process is not only outside of its limits (solid red line); its rate of change is very rapid.



[xxix]

Optimal Performance

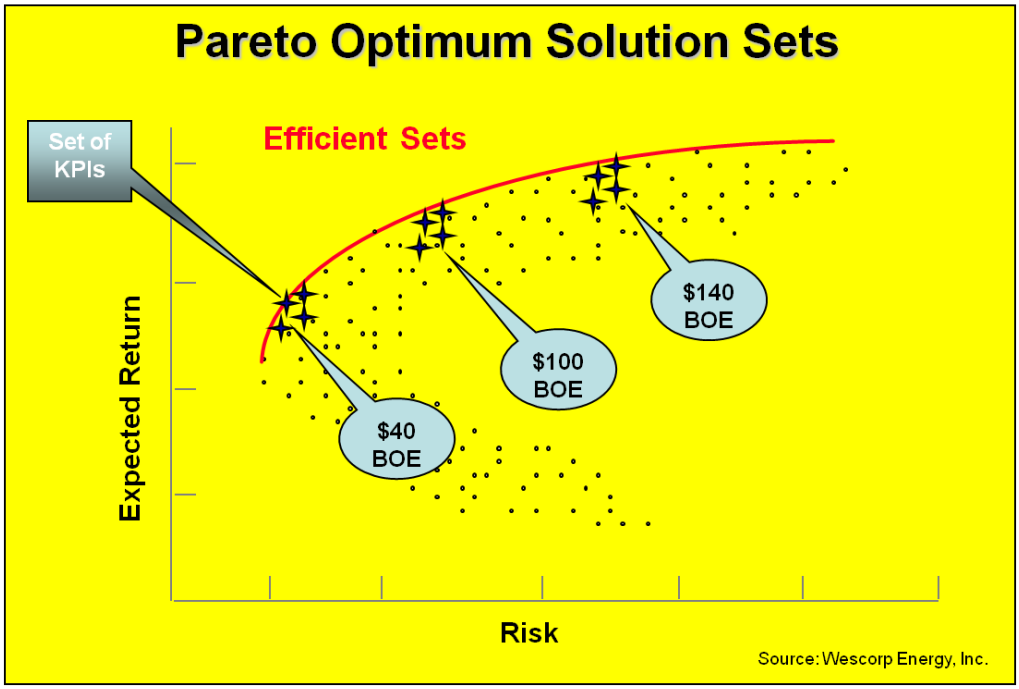
The economic efficiency frontier or Pareto efficiency is defined as that set of value allocations where no further Pareto improvements, (a change from one allocation to another that can make at least one individual better off without making any other individual worse off).[xxx] In other words, along the economic efficiency frontier (depicted as the red line the following graphic) the "set" of variables is optimized.

If one defines the set of Pareto as the Key Performance Indicators (KPIs) for any given activity as that set of organizational variables whose desirable outcome is clustered along the efficiency frontier. This mental model provides a strong framework to assure the organization is performing at its optimal level.

The efficiency frontier is a function of the expected (stochastically derived) value as a function of risk. In other words, this is a statistically based model as opposed to a deterministic representation.

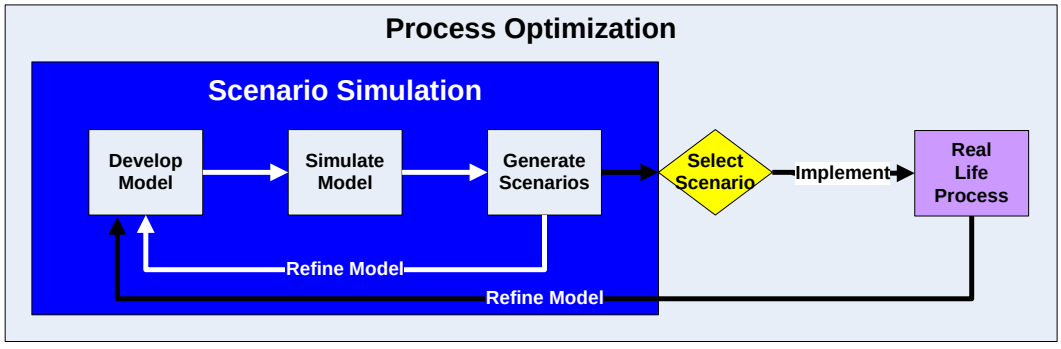
In the case of the crude oil commodity, KPIs may cluster differently along the efficiency curve as a function of the commodity price point. In the graphic depicted below, both the expected value and the risk are higher at $140 BOE than at $40. This is both logical as

well as suggesting that risk mitigation processes should be more robust at the higher price points.



By integrating the two constructs; Statistical Process Control and Pareto Optimum into a single model, we are able to manage business processes using scenario simulation. Simulation, such as is currently used to more effectively manage oil and gas reservoirs as well as many manufacturing processes, enable us to "test scenarios" on the computer and determine ramifications of our decisions, include assessing unintended consequences as well as assessing gaps prior to conducting expensive field trials.

Moreover, this approach can enable organizations to react much more rapidly when *events-on-the-ground* change quickly. By conducting multiple scenarios, management buys itself the time necessary to assess alternatives and bring to bear the best and brightest thinking available both inside and outside the organization.



Models are updated both with simulated results as well as input from the real world as reactions to events are tweaked. When a inflection point turns rapidly in one direction or

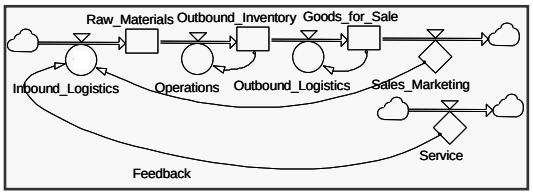
another, such as the price of crude oil in the summer of 2008, management can "what if" or "game" situational response.

What If?

With the potential high cost of failure, in both economic terms and possibly significant career damage, management often is not as aggressive as competitive forces might dictate. *Structural Dynamics* is a low risk and low cost approach that enables the expeditious evaluation of multiple opportunities beyond simple ROI.

A Broad & Informed Approach to Decision Making and Problem Solving,

Integrating Past Experience with New Experimentation (Σ^2)



Decision and ROI scenarios can be played out on the computer in much the same way engineering and plant process models are used routinely. Employing many of the same mathematical and data handling techniques, this capability is now routinely available for the management of business processes. For example, the typical strategic process of raw material input, operations, outbound logistics, and marketing inherent to many operational processes can be modeled and then simulated.

Our methodology capitalizes on the key data and managerial expertise in a unique manner that allows the user to utilize this tool as an ongoing software application that is driven by the real-time environment of the firm and its market. The tool capitalizes not just the internal business processes, but also the environment in which the firm is evolving.

Using a combination of data management techniques including the real-time input of internal or 3rd party data, statistical data handling, proven process simulation, and current user interfaces, management can effectively **"game"** the impact of potential decisions without risk. Moreover, for those sensitive new product or M&A opportunities, the firm can "test" the activity without telegraphing intent to the market.

RRM Matrix

All control based systems sense and respond to changes in their environment. Whether reacting to the touch of a hot stove or changes in the firm's marketplace, systems do respond. The question; however, is do they respond in *process relevant* time?

Historically, logistic models have stockpiled material in depots to meet expected business requirements. Hedging against process disruption by assuring adequate parts availability plus a buffer, this inventory model worked well when the velocity of information was slow. For example, a Clipper ship rounding the horn with a hold full of cargo bound for San Francisco carried a manifest and small bits of information was transmitted by telegraph from the shipper to the receiver.[xxxi]

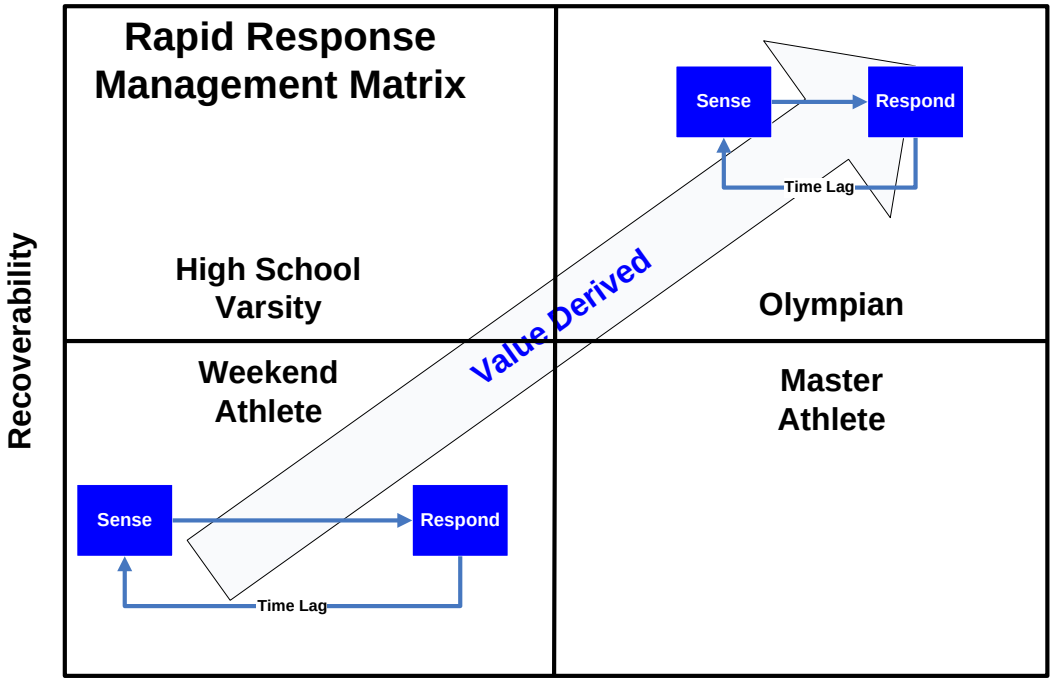
This process worked well until structural change caused by the Just-in-Time (JIT) dynamic conveyed competitive advantage to those whose process cycle time was now faster enabling a dramatically lower *inventory carrying cost model*. Adapting to rapid environmental changes, the Sense and Respond based model is emerging as a better construct to dynamically position inventory across global depots, thus enabling an even faster process cycle time.[xxxii]

Decision support processes like athletes can vary widely across industries, their segments, and individual organizations. To achieve top level performance requires a significant and sustained commitment to excellence across economic cycles and structural changes. In reality, most cannot or will not be able to remain at the top of their game over extended periods.

Another approach is to tailor the response rate of the organization from a *fit-for-purpose* perspective. Process relevant means different things to different organizations and can be a function of the problem that is being addressed, industry and organizational cultures, funding availability, and organizational maturity.

The old adage, one hiker saying to another, *"I don't have to be faster than the bear, I just have to be faster than you"* has some merit in the competitive business world. Fleetness-of-foot is relative.

It is useful to view the Rapid Response Management Matrix from the metaphoric perspective of an athlete. Assuming that we are up off the couch and engaged in competitive behavior, there are two major components to athletic ability.



Athletic performance is a function of the level of individual fitness and the ability to recover after exertion. VO_2max is a useful KPI for measuring athleticism.[xxxiii]

The level of fitness or fitness maturity is a function of training and talent. The weekend athlete is active infrequently and as such has a higher risk of injury or fatigue. The high school varsity player is usually younger and in better shape than the weekend player with a faster recovery rate, but his or her mind and body are still maturing.

Master athletes are typically over the age of 40 and compared to their peer group are in excellent shape. However, a number of physiological changes occur with aging that may

impact athletic performance, including decrease in muscle mass, decrease in maximum heart rate, and decrease in VO_2max.

The Olympian is at the top of his or her game. Training, dedication, coaching, et al. result in an individual who is world class at that moment in time.

Organizations are like athletes as well. Some in poor condition and others best of class. For our purposes the RRM matrix is composed of four classifications.

One important distinction for this model vs. many managerial constructs; *it may not be necessary or even desirable for all organizations to be an Olympian*. Depending on the market segment served or economic cycle, it may be appropriate and fit-for-purpose to be a Master Athlete or even a High School Varsity Athlete. Since there is a cost associated with organizational transformation, executives may wish to move through all stages to the top of their game or settle for something less but a lower cost.

We define the four components of the RRM matrix as follows:

High School Varsity This organization is often new; start up or spin out firms. Filled with youthful enthusiasm it challenges the status quo. Occasionally, they burn brightly and then plunge to earth in a meteoric fireball. • Often outliers, initially in the 5 percentile • Early stock growth can be explosive and they often far out perform in the near term • Kudos from all stakeholder quarters • Organizational VO_2max is Very Good	**Olympian** This organization is at the top of its game, with strong endurance, rapid recovery from adversity, and seemingly flouting market forces. • Consistently a top performer across business cycles. • High long-term stock multiples • Focus of envy and fear from competitors • Organizational VO_2max is Superb
Weekend Athlete This organization is in pretty good shape. We define this as the situation most competitive firms will find themselves. They are slower to recover than other athletic firms. They are often the protectors of the status quo, resisting change as not applicable to them. • Generally, they fall well within two standard deviations of industry metrics • Stock performance is middle of the road in up markets and falls more in down ones • Often they are viewed as good but not great by analysts • Organizational VO_2max is Average	**Master Athlete** This organization is at the top of a mature game. Maturing from the High School Varsity or throttling down from the Olympian, they dominate their niche (perhaps in a thin or mature segment). • Consistently a better than average performer but not stellar • Better than average performance in the stock market • Believed by many to be a good solid player. • Organizational VO_2max is Good

Because organizations that are in better shape, have better ability to respond to competitive and economic pressure, there organizational VO_2max enables them to sense minute changes and respond faster and more appropriate than those firms not in as good condition. Top athletes will even sense the changes in the speed and path of the baseball or tennis ball while in-flight and their predictive response has them *skating to where they think the puck will be*.[xxxiv] Using the precepts of RRM organizations can develop similar instincts.

Much like top athletes, it is difficult to maintain a corporate culture tuned to the highest performance. A great deal is required at these top levels and some corporate cultures do not lend themselves to holding this razor edge.

There are a lot of reasons this may be the case, for example:

- In mature or declining market segments, the economic investment may not justify Olympian performance where the Master Athlete level may be sufficient
- Immature organizations may not be able to advance past the High School Varsity level until a certain level of growth or development is achieved
- Master Athlete may be the appropriate level ONLY if all other competitors are in the Weekend Athlete quadrant

Master Athlete organizations should always be looking over their shoulders at the High School Athlete companies as their high organizational VO_2max may cause them to leap-frog into the Olympian quadrant at the detriment of the Master Athlete firm.

In no case is the Weekend Athlete an acceptable level of performance. Prone to injuries or worse*, on-again-off-again* activity is described by health professionals as a poor substitute for even a little consistent exercise. Companies in this quadrant are at great risk—hardly the risk mitigation model that RRM enables.

Every other quadrant of the matrix offers a more responsive capability than the Weekend Athlete.

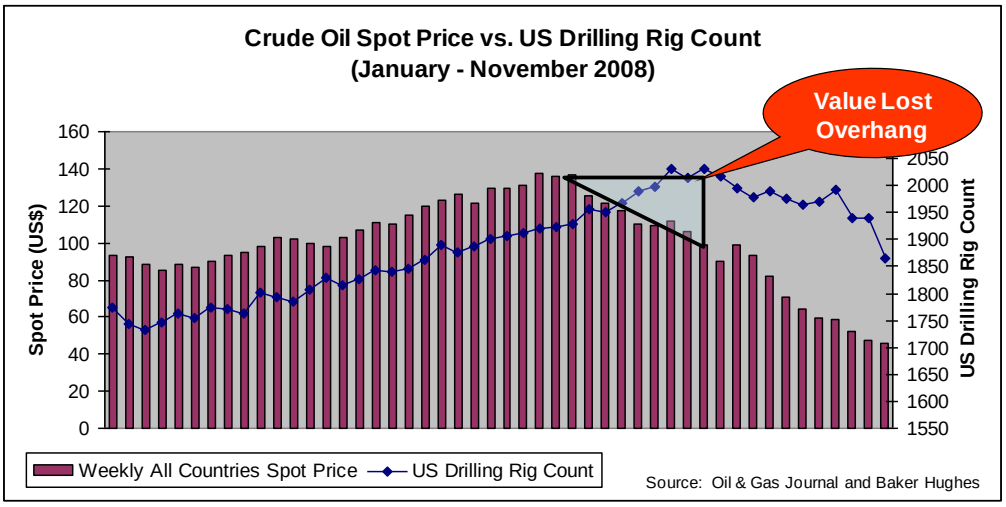
Finally, this progression from the Weekend Athlete to the Olympian or some other sustainable level of performance is not linear. Shades of gray exist, and perhaps somewhere at the cusp of the High School Varsity, Olympian, and Master are the Collegiate and Professional athletic levels.

The purpose of any management tool or matrix is simply to illuminate a path forward. Variations are expected and should not be unanticipated.

RRM Architecture

So far, we have developed a new management model that enables organizations to rapidly address changes in their marketplace. In our previous crude oil price vs. drilling rig example, the delay between the rapid decline in the price of crude oil and the response of the drilling industry represents a loss of value, depicted on the curve as *overhang*.

If one applies calculus to this area of lost value, one can determine the mathematical value lost by delays in the sense and respond mechanism. The area under a curve represents calculated numerical value.[xxxv] This value is expressly definable and represents *lost value* as a result of delay once change in the environment was originally *sensed* (in this case public data is available) and the appropriate *response* taken.



The RRM model requires a robust decision support system enabling decision makers with the necessary lens or insight into scenarios. This field operations based solution is designed for the enterprise, but can be tailored at a lower level if necessary.

The Rapid Response Management Information Architecture is both a bottom up model and a top down solution. There are fundamentally two types of data available to the decision-maker; structured and unstructured.

Structured data is typically defined as that data that can be easily captured in an electronic database. Unstructured is the other data, i.e. hardcopy or offline written documentation.

A complex system such as RRM still must be used by executives, field operations, and key supplier personnel. User interfaces must be tailored to meet the needs of individual constituents and this online system must reside on a neutral site(s) outside corporate firewalls.

Enterprise Resource Planning (ERP) systems are designed to manage corporate finance among other sensitive data and information. Systems designed for manufacturing and field operations must enable the supply chain directly.

Sensitive data and information is typically provided to suppliers, i.e., during the Request for Proposal (RFP) process and/or design, construction, operations, and maintenance of people, plant, and equipment (PPE). An RRM solution is designed to manage this type of confidential information in a secure manner—in fact more secure than traditional drawing exchange or email.

Information Technology Stack

Fundamental to any decision support system is data. Process relevant real-time as well as ad hoc on-demand data is necessary to assure management that the RRM decision support model is valid and reliable—of the highest quality.

Field Sensors

The RRM model is a *Sensor-to-Desktop* paradigm. Process relevant real-time data typically is taken from SCADA or other online process metering systems. This data is extracted by the RRM solution without impacting on process control in any way. Additional data and information is available about equipment and material in the field using RFID (radio frequency identification) tags and/or other identification means.

> *This section is taken from the author's forthcoming article in the Oil Review Middle East,* A New Era of Supply Chain Management: Gulf of Mexico Case Study.[xxxvi]
>
> The RFID tag is simply an identifier. The RFID tag does not hold all of the information necessary to manage this gear; it simply identifies the specific transponder as one of many. Additional back end operations and maintenance (O&M) information is required. For example, operators, service companies, and engineering contractors are demanding:
>
> - Web-based, collaborative solutions for managing the maintenance lifecycle of geographically dispersed assets to accelerate and streamline their ongoing operation and maintenance activities significantly increasing their return on investment.
> - Automated workflows that notify specific individuals of project deliverables and tasks with task completion verification that ensures accountability and the capture of true completion dates for mobilization/demobilization accounting.
> - Project status reports that empower management of third party vendors.
> - Sarbanes-Oxley driven asset management techniques using a traceable (auditable) construct.
> - Integrity management throughout the lifecycle of the asset.
> - Concurrent document management that eliminates time delays associated with document retrieval, delivery and approval.
>
> The RFID tag is the front end of the full operations and maintenance support process across the supply chain and throughout the asset lifecycle. It is an enabling technology for the *digital oilfield*.

Data

All organizations have a mix of structured and unstructured data. Moreover, this data may or may not reside inside organizational libraries or databases. Often it is in the hands of the suppliers who acquired the data on behalf of the organization or in the commercial data stores the organization has licensed.

Data is not static. It is constantly changing. Sometimes it is enhanced with newly acquired data and sometimes it becomes obsolete.

Managing this data requires both knowledge of information technology and the database applications that enable these major data stores as well as the domain knowledge specific to the business and industry sector(s).

Sense & Respond Field Inventory Management

Most inventory management solutions are tailored and evolved from either the retail or discrete manufacturing model. In other words, product or material moves from manufacturer to some integration process (assembly or retail selling process) then out to the final end user.

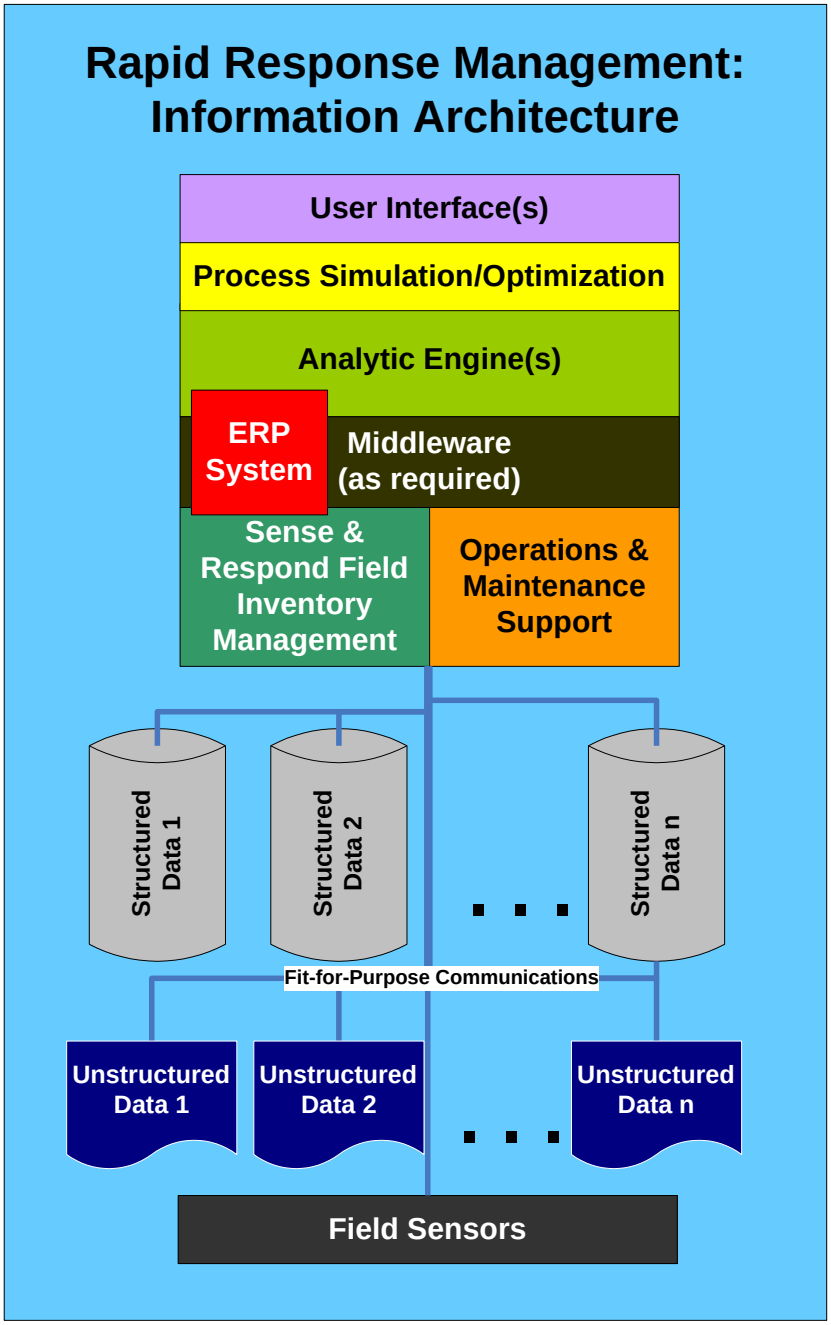
While this model is often appropriate and in some cases highly tuned, it may not be the best way to manage a *depot* based, global logistics environment such as can be found in organizations with a high level of field service, e.g. aviation, maritime, military, or oil & gas operations processes. In these types of environments, **Total Asset Visibility of Operations** (TAV-OP) has two major components:

- An inventory management solution that recognizes the unique operational demands of these types of requirements present, and
- Enhanced visibility into the nature of the equipment and material, for example, compliance reporting, maintenance records, operator certification, etc.

Moreover, in today's global enterprise, data and information must be stored in a secure online system that enables organizational personnel and their 3rd party partners to access and manage data and information in a *concurrent* manner. If a piece of equipment is shipped from a depot in the Middle East to one in Asia Pacific, individuals in the Gulf of Mexico who may also be looking for a similar item need up to the minute information that this transaction has transpired. It may also be necessary to know the maintenance history of this piece of equipment and its bill of materials (BOM) and the individual that last operated it and in what environment.

A useful Sense and Respond solution requires a complete set of institutional knowledge about material and equipment and the personnel that operate/maintain it, if it is to be assured of fit-for-purpose in its intended use. These requirements are unique to the field service environment and dictate the mandatory construct that RRM incorporate this capability.

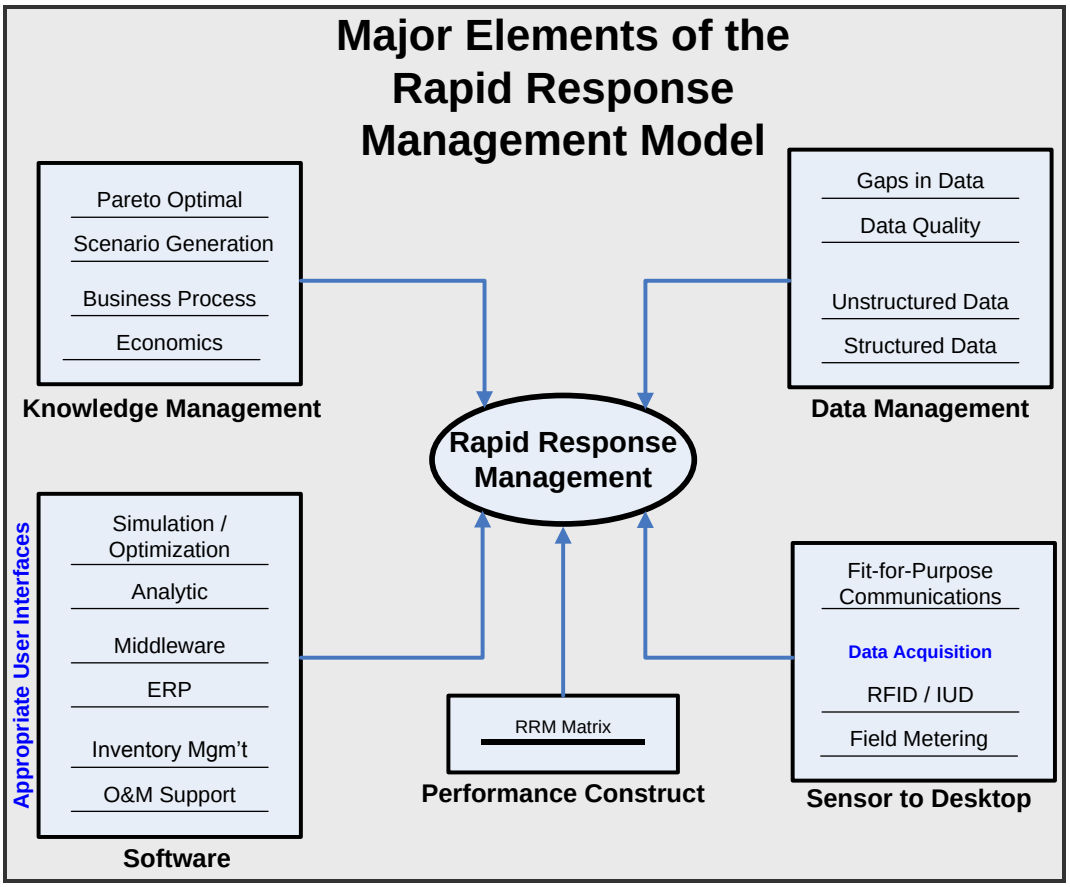
Moreover, **Health, Safety, and Environment** (HSE) concerns and regulations require this level of detailed information. In other systems, this may not be as available in a timely manner.


Rapid Response Management:
Information Architecture
User Interface(s)
Process Simulation/Optimization
Analytic Engine(s)
ERP System
Middleware (as required)
Sense & Respond Field Inventory Management
Operations & Maintenance Support
Structured Data 1
Structured Data 2
Structured Data n
Fit-for-Purpose Communications
Unstructured Data 1
Unstructured Data 2
Unstructured Data n
Field Sensors

Delivering an RRM Solution

While a Rapid Response Management solution may appear to be complex, even daunting in reality it is really straightforward and readily attainable. The management model is composed of five major sections:

- **Knowledge Management**, or those *SUBJECTIVE* thought processes unique to the human being.
- The **Software** application suite that *EMPOWERS knowledge workers*.
- The **Performance Construct** articulated in the RRM Matrix that determines the LEVEL OF FITNESS and RESPONSIVENESS for any given organization during its life cycle.
- A **Data Management** system designed to enable decision-makers to *NAVIGATE* massive data stores in a straightforward manner.
- A **Sensor to Desktop** system designed to *FEED* process relevant real time data and update management control of decision processes on an ongoing basis.



Many organizations already have many of the components of the RRM solution. Therefore, any RRM implementation must take into consideration the current organizational and technical landscape, adapting and integrating as required.

In most cases, the development of an RRM solution does not involve major software capital expenditures or long running consulting contracts. Straightforward integration into existing processes and information technology architectures is desirable and doable.

Case Studies

The Rapid Response Management construct is being introduced in this White Paper. However, there are existing case studies where components of RRM have been used in real world scenarios and proven successful. This section provided five basic case studies that address the process manufacturing sector as well as the military and petroleum production segments.

These proof points document the measurable economic value that can be attained using RRM techniques and tools. Covering a broad range of global organizations, the applicability of RRM to a spectrum of enterprises is appropriate.

Process Manufacturing

Process manufacturing is a global, asset intensive, competitive, low margin industry. To be successful in this segment, firms must find ways to reduce operational costs while increasing revenue. Successful companies understand and implement plans to automate operations, manage compliance, provide total asset visibility across the global enterprise, and drive efficiencies from process operations.[xxxvii]

In a recent study of 200 firms in this segment, **Best-in-Class** firms (one key differentiator is the ability to deploy technology to gain better visibility in to operations) were found to:

- Use *analytics* 64% more often than others in the segment
- Use *process modeling and simulation* to determine "best path" at the local plant (asset) level 81% more than others.
- Be more likely to have implemented *Statistical Process Control (SPC)* and advanced *process control* systems.
- More likely to have integrated process *simulation* and behavioral analysis with *analytics* to better understand process characteristics and improve operations.
- Model the manufacturing process as an important part of gaining proper *visibility* into operations.
- Use modeling and simulation to tighten control limits around the process as well as reducing instability.
- Use "What if" scenarios developed from modeling and simulation to assess process upset prior to real world events occurring.[xxxviii]

The aggressive use of simulation and analytics requires that real time and historic data feeds enable these software applications. Moreover, accurate inventory systems such as the one discussed in the next case study further enable Best-in-Class firms to remain competitive and profitable.

To date, these firms are not implementing the full robust RRM solution, yet the results have been superb, both in cost management and profitability. This suggests that even partial use of RRM can have immediate and measureable value.

Military Operations

While sense and respond inventory and logistics management systems are relatively new, these types of solutions have been deployed on a global basis and currently manage high value, mission critical equipment and material for a number of military organizations. This tested approach enabling adaptive response to discontinuities has shown to add significant tangible and intangible value.

Tangibles include:	Intangibles include:
➢ Inventory costs reduced up to 30%-- better cash management through decreased working capital requirements	➢ Improved item management and accountability
➢ Increased equipment availability up to 10-15%	➢ Improved asset visibility and life-cycle management
➢ Reduced equipment losses during shipment up to 3%	➢ Faster and higher quality audit
➢ Reduced production downtime up to 10%	➢ Improving organizational response to the dynamics of the market
➢ Reduced personnel costs up to 30%	➢ Improved insight into the full spectrum of business and logistics functions.

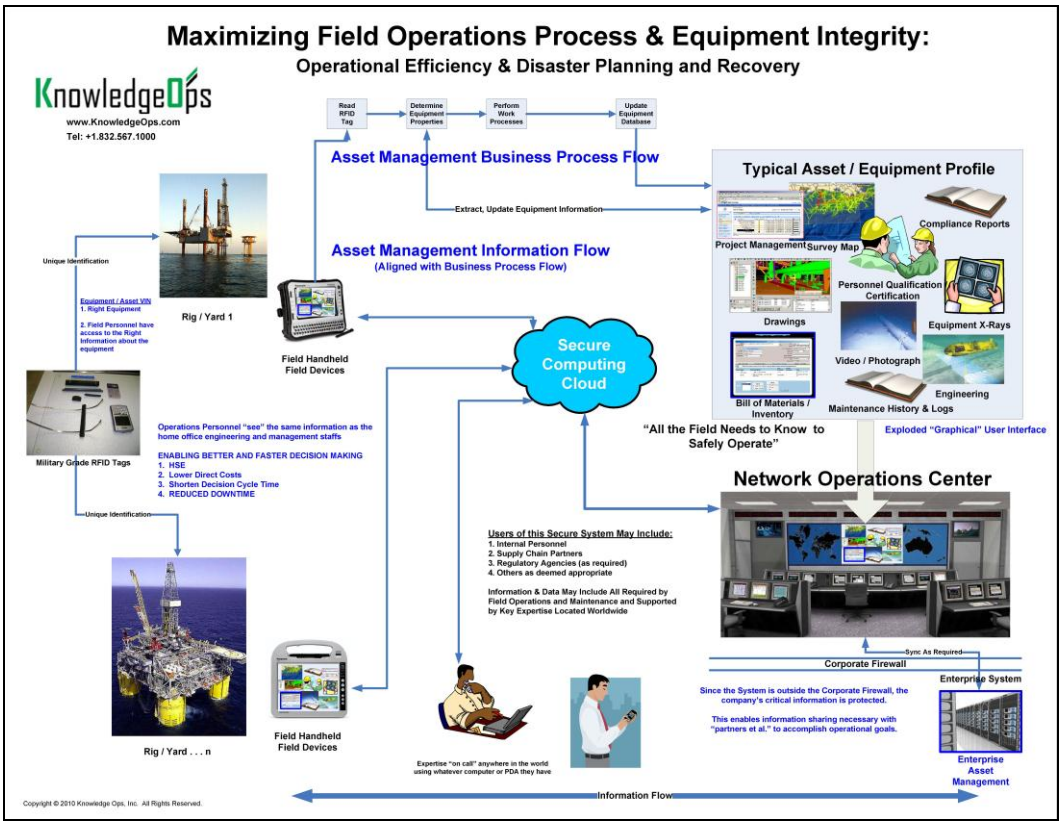
The business and economic case for industry, especially global logistics intensive operations to adapt to a new paradigm for supply chain management is compelling. All the more so since the sense and respond model has been extensively vetted by other organizations facing similar challenges.[xxxix]

The aggressive use of RFID to identify material and equipment is critical to the sense and respond inventory system. These fit-for-purpose tags are now very cost effective and easily managed.

Oil & Gas Production

The cost of extracting and producing non-conventional crude oil can be substantial. Managing the development of this asset class in today's economy can be challenging at least. In 2008, Operations and Maintenance Support in the form of Wescorp Energy Services USA's NAVIGATOR solution was deployed to support field operations and enterprise data room for a mid-size non-conventional oil producer in northern Canada.

This solution provided critical visibility into material and operations at the remote field site. Typically, a variety if data and information from a number of sources was required to be viewed and acted upon by field personnel, key suppliers, and management among others in a secure format. Information such as shown in the following graphic was made available to these constituents.



For this project five categories of value were identified and are listed and defined in the following table. The KPIs drove the implementation of this project.

Category	Definition	Example
Cost Takeout	Completely eliminating a specific activity or process	Redeploying a resource from a non value-added activity to a value-added activity
Cost Avoidance	Identifying and correcting an error that was not budgeted for correction but would have caused an expense had it not been corrected	Correcting an engineering design flaw before the flaw goes into production.
Productivity & Efficiency Gains	Increase in productivity that improves existing resource utilization.	Removal of a bottleneck that is causing capacity restraint Correcting a process to allow more productive time by shifting from wait time to production time
One-time Cash Flow Impact	Decreasing and or eliminating one-time cash flow impact	Elimination of redundant information/data stores Monetize Capital
Intangible	Benefits that improve operations of the business and /or are necessary to control, protect and enhance company assets, but are not quantifiable due to the nature of the area being improved	Improvement of communications between different operational units/supply chain Reduced small equipment shrinkage

Value was achieved in all categories and a typical (but abridged) listing is provided below.

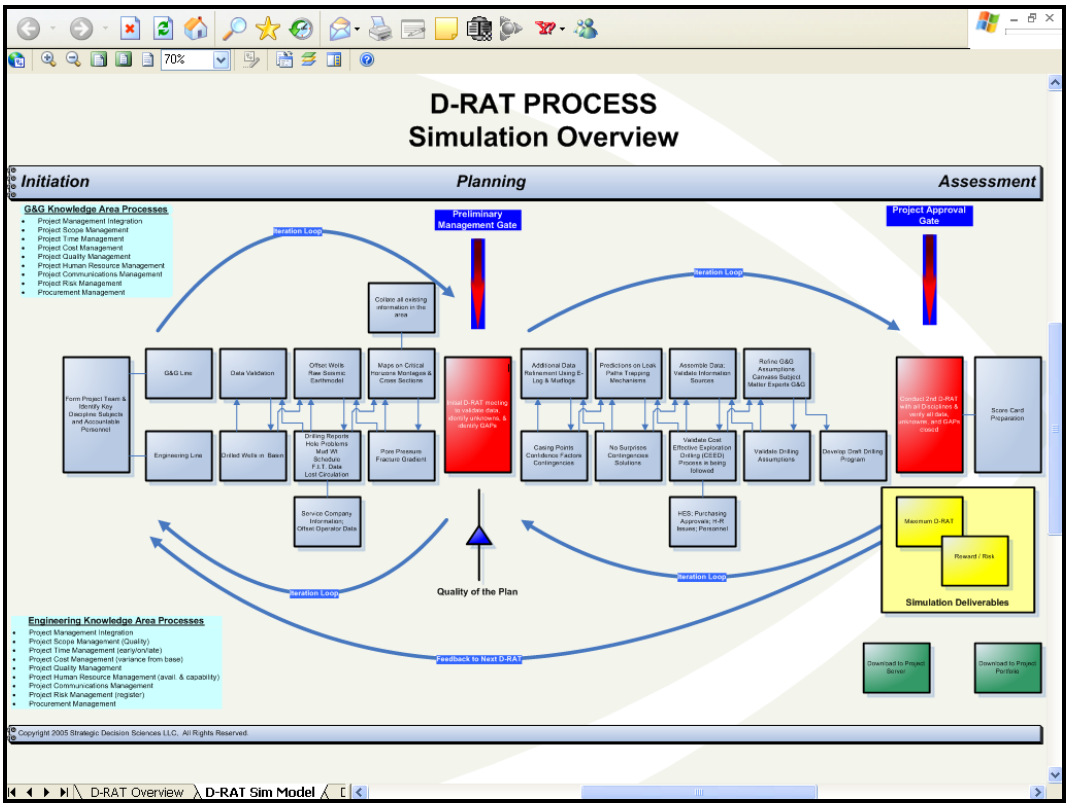
Area of Activity	Category	Description	Expected Value
Corporate	Cost Take out	Navigator provided as a service, therefore, capital dollars are free for other purposes	Cost of capital (money)
Admin Services	Cost Take out	Reduction in the number of disparate computer systems holding mission critical data	minimum 25%
Field Operations	Cost Take Out	Curbing equipment downtime	Cost of downtime
Field Operations	Cost Take Out	streamlined maintenance and operations practices	15-20%
Field Operations	Cost Take Out	Reduction in unexpected/unplanned events and faster recovery from these events	3-8%
Field Operations	Cost Take Out	Reduction in unnecessary and possibly harmful maintenance	up to 50%
Field Operations	Cost Take Out	Use of RFID to more effectively track rental equipment	8-12%
Field Operations	Cost Take Out	Use of RFID to more effectively assets and tools to reduce loss/misplacement	maximum 5-8%
Field Operations	Cost Take Out	Use of RFID to manage logistics reducing the number of instances of project delay waiting on equipment/material	up to 50%
HSE	Intangible	Use of RFID to assure new contractor personnel are assimilated into the project faster	10-30%
HSE	Cost Take out	Use of RFID to assure safety compliance for employees and contract personnel	25-30%
Field Operations	Cost Take Out	Use of RFID to assure equipment is in compliance for the task and task timeline	20-25%
Field Operations	Cost Take Out	Use of RFID to assume more effective management of inventory and material	8-10%
Field Operations	Cost Avoidance	Permitting office headcount redistributes responsibilities and eliminates headcount requirement.	3-5%
Field Operations	Cost Avoidance	Electronic distribution of information reducing errors, rework, and personnel	up to 30%
Field Operations	Cost Avoidance	Facilitation of concurrent engineering processes across the supply chain	up to 50%
Corporate	Intangible	Showpiece to market that the company employs new technologies effectively to increase the value of the asset base and subsequently the stock price--governance	12-14% premium
Corporate	Intangible	Development of the asset data room facilitating potential partners due diligence	potential increase in the value of the deal 3-5%
HSE	Intangible	Response time to HSE events: spills, injuries, Improvement in accuracy and timeliness of reporting to regulatory agencies	up to 50%
Field Operations	Productivity & Efficiency Gains	Improvement in project engineering and execution.	6-8%

Substantial and near-term value was derived, and paraphrasing the words of the Chief Geologies, “the value of the asset did not increase as the result of this data room, but the time it takes to sell the property should be shorter.” This in addition to the categories of value defined above.

Risk Assessment

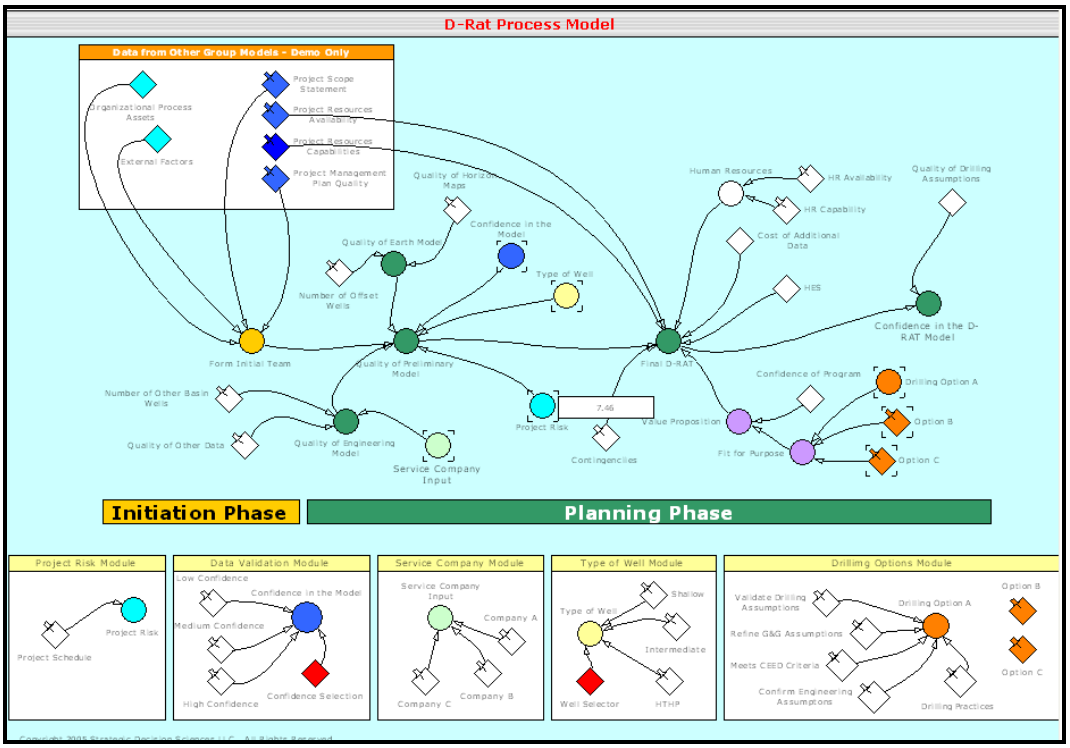
Using process simulation, a prototype of a drilling risk assessment solution was developed in conjunction with a super independent oil and gas firm. The purpose of this model was to develop Go-No Go scenarios for expensive and difficult oil and gas well drilling.

Initially, the process is captured, documented, and validated with the users. The following overview provides a snapshot of what one drilling manager said, “Was the first time he ever saw the entire assessment process as one flow chart.”

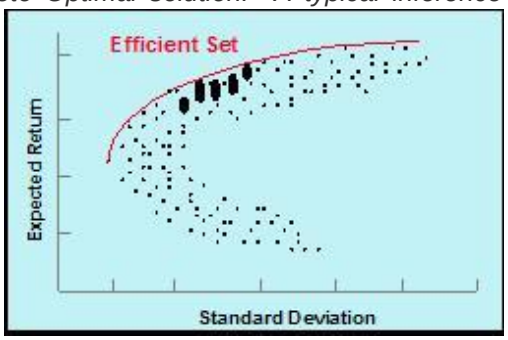


Once this has been accomplished, the simulation itself is developed by modelers as part of a team; a multi-dimensional team that includes domain experts, IT experts with oversight provided by the client.

The simulation model, as shown below, was built using Project Management Institute’s Best Practices or PMBOK.[xl] This assures that the model is developed using industry standards and is valid and reliable, in other words repeatable.



The following is taken from an article written by the author in 2006 that describes the results of this project.[xli]

> *The inference engine runs a series of iterations that steer large variables sets to convergence at a Pareto Optimal solution. A typical inference engine will control the workflow and data input of the overall process. It would include the ability for management to override based on an individual or group of individuals' knowledge.*
>
> 
>
>
> *Finally, the output feeds to executive dashboards, thus adding a level to field intelligence that typical solutions, including those with Monte Carol simulation, cannot emulate. This is the beginning of real analytic and decision support power—the Pareto Optimal solution that decision makers from the field to the board room can use to attain competitive advantage!*
>
> *The output includes a number of scenarios from which management can select implementation plans. For example, one recent simulated scenario saved a refinery almost **18%** during an upgrade process. The value is documented, and it is substantial.*

This approach towards asset utilization is grounded in economics and capitalizes on proven portfolio management techniques to realize significant value to the firm. This type of solution has been used in other industries with great success and it is now poised to do the same for upstream oil and gas.

This is essentially a capital allocation model. By helping management develop an effective expected cost for each well construction project in the portfolio, operators are better able to manage CAPEX realizing better overall portfolio perspective. For example, if the expected cost range is narrowed, less capital will have to be allocated for any given project. Likewise, if cost overruns are minimized then that capital can be put to other and better uses.

Traditionally, capital is thought of in financial terms. Today, human, equipment, and material capital are in even shorter supply than money. The efficient allocation of these types of capital is at least as important as the financial component.

The power of these simulation models is substantial and even greater potential can be derived using scenarios in a predictive manner.

Sensor to Desktop

Two Canadian "junior" natural gas producers were collecting production data manually. In other words, operators would drive out to the wells to individually either pick up and replace BARTON® Chart Recorder[xlii], read *flash memory cards* from stand alone digital meters, or read older pre IP (Internet Protocol) meters. All of this was a costly and time consuming data collection method.

These companies needed to accomplish two tasks. First they needed to extract data electronically on a "real time" basis from in situ instrumentation without replacing expensive metering systems, and they needed to make this information available to investors, regulatory entities, and others in a secure online manner.

A solution was put in place that enabled these companies to securely transmit data, enabling:

- Timely, accurate production data capture and availability
- Automated manual processes
- Enabled remote asset monitoring
- Optimized O&M processes
- Integrated disparate data sources
- Asset visualization symbolically correct
- Enhanced measurement accuracy

In the words of the Vice President of Production of one of these firms, "This solution not only enhances our operational knowledge, but eliminated the monthly reconciliation process thereby saving us significant time and expense." He went on to state that, "We now have real time production information and can respond more rapidly to production disruptions."

By overcoming the limitations associated with pre-IP metering, for which by one count number in the millions of units worldwide, production operators are now able to integrate legacy meters into the digital oilfield environment.

There are a significant number of legacy metering systems throughout all heavy industries. The cost of replacing is often not economic, even horrendous. Bringing these systems into the IP era at minimal upgrade cost is a huge economic value to the firms that own these devices.[xliii] The implementation of the RRM solution for these gas producers added significant value to the organizations. In one case, the sales price of the company!

Further Case Study Information

Additional information on the above case studies as well as other RRM projects is available from the author. His contact information follows.

About the Author

Scott M. Shemwell

For over 30 years, Dr. Shemwell has led the turnaround and transformation process for global S&P 500 organizations as well as start-up and professional services firms. His specific experience includes Executive Management, Information Management, Mergers and Acquisitions, Change Management, and International Business.

He was business unit head with P&L responsibility and member of the Executive Leadership Team for an S&P 100 firm. He has led or been a key individual in over $5 billion in mergers, acquisitions, and divestitures. As the Managing Director for a major consulting firm, he assisted clients in transforming themselves throughout the globalization process.

He is a leading authority (frequently quoted & referenced) on information management, business processes and industry change, as well as organizational structure analysis, with over 300 publications and speeches.

Glossary

The following terms are used in this White Paper and the definitions are provided for completeness and reader convenience. The author makes no representation that the definitions are accurate and/or complete.

Term	Definition
Barrel of oil equivalent (BOE)	The barrel of oil equivalent (BOE) is a unit of energy based on the approximate energy released by burning one barrel (42 U.S. gallons) of crude oil.[xliv]
Economic efficiency	**Economic efficiency** is used to refer to a number of related concepts. A system can be called economically **efficient** if: • No one can be made better off without making someone else worse off. • More output cannot be obtained without increasing the amount of inputs. • Production proceeds at the lowest possible per-unit cost. These definitions of efficiency are not exactly equivalent. However, they are all encompassed by the idea that nothing more can be achieved given the resources available.[xlv]
Fit-for-purpose	Terms used to describe a process, capability, product, or solution that is suitable for its intended use.
Flash memory card	A solid-state electronic flash memory data storage device http://en.wikipedia.org/wiki/Memory_card
Internet Protocol	A TCP/IP network layer protocol for addressing and routing packets of data between hosts on a TCP/IP network. http://www.thenetworkencyclopedia.com/d2.asp?ref=999
Inventory Carrying Costs[xlvi]	Cost of holding goods in stock. Expressed usually as a percentage of the inventory value and includes cost of capital, warehousing, depreciation, insurance, taxation, obsolescence, and shrinkage. Also called inventory cost.
Key Performance Indicator (KPI)	Key Performance Indicators are quantifiable measurements, agreed to beforehand, that reflect the critical success factors of an organization.[xlvii]
Non-conventional crude oil	Petroleum sources as including oil sands, heavy oil deposits, and oil shale. http://www.gao.gov/new.items/d07283.pdf
Rapid Response Management (RRM)	An organizational construct or mental model that enables the organization and its key partners to rapidly sense changes and respond accordingly
RFID	Radio Frequency Identification
Statistical Process Control (SPC)	A standardizing technique used for steering a process in a desired direction, reducing variation, increasing knowledge about the process, assessing process capability and providing performance benchmarks[xlviii]
Stochastic	Statistically random variation.[xlix]
Value Lost Overhang	That value that is forfeited as the result business environments change and the lag with which an organization adjusts to its new realities.
Velocity of Information	Similar to the economic theory, Velocity of Money, it is the frequency at which information is exchanged.
VO_2 max	VO_2 max (also maximal oxygen consumption, maximal oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and utilize oxygen during incremental exercise, which reflects the physical fitness of the individual. The name is derived from V - volume per time, O_2 - oxygen, max - maximum.[l]

Endnotes

[i] Securing America's Future Energy and the National Commission on Energy Policy. (2005). Oil Shockwave: Oil Crisis Executive Simulation. Authors. http://www.secureenergy.org/reports/oil_shock_report_master.pdf

[ii] Union Pacific Corporation. http://www.uprr.com/customers/surcharge/wti.shtml

[iii] Google Finance. http://finance.google.com/finance/historical?cid=983582&startdate=Nov+26%2C+2007&enddate=Nov+24%2C+2008

[iv] PennEnergy http://studio-5.financialcontent.com/pennwell?Month=11&Account=ogj&Page=HISTORICAL&Ticker=%24OGJ200&Year=2008&Range=12

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