Name of the Author: J. Muthu Kumar
iWells Integrated Management Consultants DMCC, Dubai ("iWells")

J. Muthu Kumar is an upstream oil and gas industry professional with 39+ years of experience across many countries in all kinds of environment with in-depth knowledge and extensive experience in asset acquisition, development and monetization, integrated project delivery, well construction, systems, policies, principles, procedures and standards, optimization and integrated risk management, emerging technology applications, and high performance coaching. He understands technology, its growth, applications, impact and consequences, information technology and AI.

iWells Integrated Management Consultants DMCC: iWells is specialized in drilling oil and gas wells with focus on well optimization, technical and operational integrity, effective drilling execution strategies, risk mitigation and prevention, integration of multi-disciplined approach to deliver complex projects through a defined well delivery and optimization process to reduce drilling risks, cost and carbon emissions.

DRILLING as a BUSINESS UNIT: It is Time to Consider Drilling and Completions as a Business Unit and Not as a Service Unit and "Details".

Note: In this paper, Drilling refers to well construction activities (drilling, testing and completions).

Despite Drilling being one of the most essential and critical components in the Upstream Oil and Gas Industry to bring the oil and gas from the reservoir to surface, it is generally ignored during field acquisition, assessment of field potential, due diligence for funding and field monetization plans. Field Development Plans ("FDP"s) are dominated by subsurface, reservoir and economic disciplines in which Drilling is assigned and restricted to one section that may not include detailed analysis of execution challenges. This is primarily due to industry's treatment of Drilling (despite Drillex being 45-55% of the exploration-appraisal-development cost) as a Service Unit and its execution as "Details" irrespective of the level of complexity, magnitude of uncertainties, and intensity of risks involved in drilling and completions.

However, the realization of the challenges and difficulties occur only during the execution phase of drilling, which leads to various levels of compromises to several drilling projects including delayed 1st oil schedule, commercial production and monetization. The inability of the oil and gas companies to drill and complete the wells seamlessly within the planned schedule and budget further leads to investment constraints, problems in servicing the debt and creating value for stakeholders. It is not uncommon to observe fields that are waiting to commence production for years due to delays caused by operational and execution challenges in drilling.

Despite all the advances in technology, standards and processes of the last four decades, every day, at some part of the world, major drilling problems, including **side tracking, loss of well or a blow out,** keep occurring. However, even with the real time experiences and scenarios that impact the overall field development and monetization, the industry's approach to drilling is not changed.

However, with the ongoing challenges faced by the industry such as resistance to fossil fuel, tight funding and stringent condition precedents, push for alternate and renewable energy etc, it is time to consider Drilling as a Business Unit instead of treating it as a Service Unit and "Details" so that the overall performance of the organizations are achieved and sustained. It is also critical that oil and gas companies, investors, lenders and regulatory seek a **Drilling Competency Person Report ("DCPR")** along with the CPR for subsurface and reservoir engineering during acquisition and investment decisions because even if subsurface/reservoir CPR is positive, without the ability to drill the wells as envisaged, the success of the development plan is uncertain.

1.0 Drilling During Field Acquisition and Exploitation – Current Practice

The industry practice during the assessment of field potential, acquisition, development of field monetization strategies and fund closure, is generally limited to:

- Detailed evaluation of subsurface models, in-place and reserves, production profile, oil prices and project economics, but the scope of drilling is limited to an over-view with arm's length cost estimates.
- The CPR (Competent Person's Report) required by oil and gas companies, investors, lenders and regulatory is mostly restricted to subsurface and reservoir engineering work.

- Although drilling spends 45-55% of the field development CAPEX and is essential to bring the oil and gas to surface within the proposed schedule and budget, a quality due diligence on drilling is not done.

Unlike subsurface, reservoir and production, drilling rarely plays an equal role and is not part of sculpting the business model of an oil and gas corporate.

The consequences of discarding drilling from participating in the business case are that:

- ➔ drilling risks, complexities, uncertainties and their impact on schedule, costs and deliverables are ignored during the development of project business case, fund closure (FID) and economics;
- ➔ potential gap in drilling project continuity due to varying as well as temporary resources;
- ➔ the reality of the risks and challenges strikes/surfaces during the execution phase which impact the envisaged field development and monetization schedule and plans;
  - ➔ due to this, several projects end up with compromised objectives or failed deliverables;

Of course, there are exceptions as always, but they are rare.

2.0 Impact of Not Considering Drilling as a Business Unit

By considering drilling only as a service unit, its boundaries are restricted mostly to execution phase rather than involvement from the onset of the project business case. In general, drilling is rarely involved in the following critical phases.

Field Acquisition Phase	(1) Data Room Views and Reviews (2) Assessment of Field Potential (3) CPR Interface (4) Project Risks and Feasibility (5) Project Economics (6) Field Acquisition Drilling is scarcely involved in this Phase and hence practical limitations and risks to bring oil and gas effectively from the reservoir to surface is not evaluated.
Field Monetization Planning Phase	(1) Field Commercialization Model (2) Lender / Investor Interface (3) Project Business Case, Economics and Schedule (4) Project Risks and Uncertainties Model Drilling is rarely involved in this Phase.
Field Discovery and Appraisal Phase	(1) Prospects and Leads Inventory Model (2) Location Selection Process (3) Subsurface Risks and Hazards Model (Not Drilling Risks) (4) Corporate/Stake Holders Interface Drilling is rarely involved, despite being the only execution arm to achieve the subsurface/reservoir objectives.
Field Development Plan Phase	(1) Field Development Deliberations (2) Basis and Strategies of FDP Drilling is assigned a section with overall project risk evaluation.

- Drilling is more fully involved during the FDP implementation phase, but by the time drilling is invited to participate, the decisions and strategies would have already created constraints that cannot be changed without a tedious process of change management.
- Drilling is then expected to deliver despite the constraints which leads to a compromise.
- Sometimes, drilling is also treated as a manufacturing facility to produce wells like a product.
- If different teams work for exploration and development, it induces a learning curve.

The limitations listed above impact the project delivery in any or all of the following:
(1) Schedule, (2) Time, (3) Cost, (4) Risk management, and (5) Deliverables.

Note: Examples or case histories are not presented here due to confidentiality. However, the impact of these limitations would be known to the organizations, investors and lenders who had experienced them.

3.0 Drilling Process in the Current Scenario

Drilling plays a major role in ensuring an organization's credibility as a prudent operator. Stamping the principles of extracting and bringing the oil and gas to surface as "Details" may look attractive, and it may even help to avoid detailed due diligence on drilling during the early stages of field acquisition and monetization plans.

However, the impact of such approach has been well demonstrated by the failed, compromised or delayed field monetization schedules due to challenges arising during execution.

Treating drilling as a service unit is not a prudent practice. Even in a known field, it has inherent risks and uncertainties due to both surface and subsurface challenges. Some of them are:

(a) most firms assume one size fits all and implement the same style of operating model to drilling projects despite varying business cultures and drivers; structure and capabilities, and processes;

(b) an aggressive fast track small and mid-size independent organization tries to implement the process of an international super major oil company;

(c) limited tolerance of leadership which does not allow drilling project alternatives, and collaborating proposals; induces advocacy models resulting in un-explored alternate better perspectives;

(d) the supporting functional discipline biases exert influence on decision making which creates a conflicting web of contradicting role distributions between drilling and support functional disciplines;

(e) lack of integration between the four pillars of a drilling project, Operator, Drilling Rig Contractor, Service Providers and Regulatory, which leads to wasted time, efforts, and costs;

(f) lack of opportunities for drilling to present its business case to management, decision makers and partners who treat drilling as "Details";

(g) lack of an integrated approach between subsurface, reservoir/petroleum engineering, production and drilling that negates a robust well design;

(h) encouraging optimistic design that negates the value of a prudent planning; inducing pessimistic execution approach that negates the value of an effective and efficient execution;

The subsurface and reservoir engineering are allowed a probability of success. So negative results are justified and accepted by the management, partners and other stake holders. However, drilling has no such margins. It is a binary "success" or "fail" mode. The target reservoir has to be reached without exception because drilling cannot stop at 5 m above a reservoir to claim that 98% success is achieved.

This fundamental difference cannot be eliminated due to the nature of the game. However, the issues can be managed more effectively if drilling is considered as a business unit and allowed to become a part of corporate business strategies and monetization plans along with subsurface, finance and strategy developers.

4.0 Drilling as a Business Unit Instead of Being Treated as a Service Unit

Drilling must be treated as a business unit rather than a service unit to:

- optimize the rational and derive practical expectations of project deliverables, schedule and cash flow projections.
- minimize the risk, failures and compromises to the planned objectives in all phases.
- ensure consistent performance to deliver the "Best Wells" as defined.
- fulfill the expectations of stakeholders and corporates and establish prudence and credibility.

Drilling is a complex process with the highest number of non-linear non-random risks[Note 1] as compared to any other disciplines in the industry. Hence, every well requires its due respect. Where caution is required, it must be adhered. The line between the true needs of cautious and optimistic approach is thin and the boundary needs to be well defined to ensure that the line is not crossed. Many problems in drilling occur due to crossing of that line.

Note 1:
Non-linear and random risks:
In these types of risks, the causes of a risk as well as the outcome of the risks (impact) are unknown and unpredictable as compared to linear and non-random risks.

In most organizations, strategic and business decisions are taken by committees who have inadequate understanding or experience of drilling complexities and risks, and they commit to production schedule and condition precedents without involving drilling. Hence, they:

- encourage optimistic attitude;
- expect drillers to be brave and confident.;
- discourage cautious, prudent and diligent drilling approach;
  - → **Failures due to excessive optimism would be accepted even with inadequate justifications.**
  - → Failures that occur after caution and diligent warning would be blamed on pessimism even with adequate justifications.

In complex projects like drilling, the pessimistic and optimistic strategies must be integrated. The design, engineering and plans must be a combination of optimism-pessimism so that all possible risks and uncertainties are evaluated, and proper mitigation strategies developed. The execution must be optimistic to manage the real time challenges effectively and efficiently. **An optimistic design and a pessimistic execution model will invariably fail.**

The irony is that drilling personnel handle risks daily unlike any other discipline in the industry. They are trained to think and act calmly in situations of tremendous pressure. Many of them are innovative and creative and natural leaders who lead by example with commanding respect. Their knowledge, experience and versatility are a good combination for valuable contribution to corporate strategies but unfortunately, they are ignored.

In the past drillers were not petroleum engineers. They rose through ranks learning the art of trade and executional aspects of drilling by hands on experience. They became drilling superintendents and drilling supervisors by experience gained by hard work. There was no time or opportunity for them to learn the fundamentals, principles, and theories behind drilling a well or contribute to the business case of the organization.

Today it is changed. The new breed of drilling leadership are qualified engineers who understand the modern concept of drilling through advanced technologies and digitalization models. They understand risk, investment challenges and corporate goals. However, the industry still has not fully accepted the abilities of this new breed and take advantage of their capabilities beyond making them to serve as a service unit. The result is compromised or delayed or failed projects even in the 21st century.

In addition to the volatility of oil prices, the industry is under pressure of climate emergency declaration and energy transition demands. Several major oil companies are already launching alternate energy ventures as a hedge against an uncertain future of fossil fuel based energy matrix.

The future, without a doubt, will be a period of intense combat to overcome the forces working against the oil and gas industry. Such forces are numerous with interdependent parameters that are complex. Some of the major factors that would influence future oil and gas industry are:

(1) rising resistance to fossil fuels, demand for low carbon emissions/carbon footprint.
(2) growing push towards renewables and alternate sources of energy.
(3) need for large investments for drilling to sustain production levels to meet the demand.
(4) loss of investor confidence due to continued volatility, growth of renewables and other alternatives.
(5) changing expectations of lenders and investors towards a holistic due diligence in place to export.
(6) increasing necessity for early and effective field monetization with minimum risk and cost.

Despite all the challenges, oil and gas will remain a strong force in the energy matrix for the next 2-3 decades as none of the alternate renewable energy sources have the ability to scale up and be as affordable as oil and gas

globally. Secondly oil and gas are the source for plenty of petrochemicals which no alternate sources of energy can provide.

In that scenario, drilling is not just about drilling and completing a well as an independent activity. It is an integrated process with clearly defined deliverables that are much beyond accomplishing just the drilling targets.

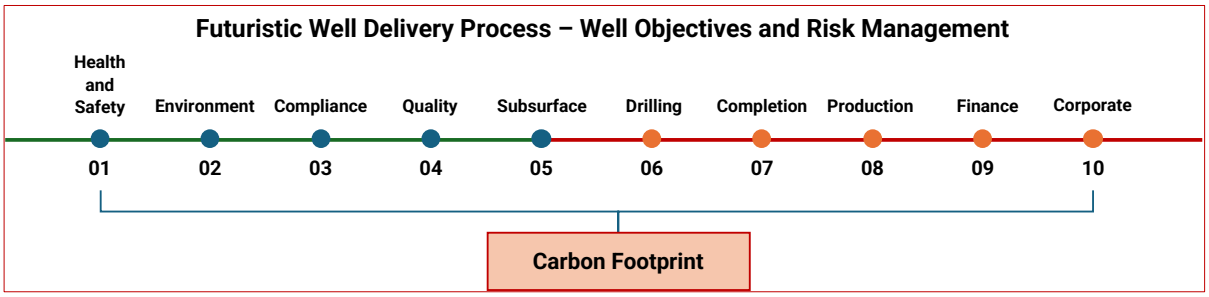

Fig. 1: Futuristic Well Delivery Objectives

Accordingly, every well must be designed and executed to evaluate risks, develop mitigative measures and deliver by managing all the risks effectively. The demand for the reduction of drilling carbon emissions in response to the Climate Emergency Declaration is an added pressure to the oil and gas industry that requires established practices and technologies to reduce carbon emissions.

Conventional approach to drilling is inadequate to achieve such expectations. Hence, the industry must undergo major transformational changes to the industry fundamentals with the help of advanced emerging strategies and technologies including the artificial intelligence. With looming challenges of the future, the only way the industry can sustain is by accelerating the steps to achieve such transformative changes.

With the advances in technology, big data science, artificial intelligence, real time analysis for optimization and remote operating technologies, a platform exists today for drilling technology to deliver the complex web of multiple objectives with minimum failures and compromises.

In the near future, the CPR (Competent Person Report) required by lenders, investors and banks will not be limited to in place and recovery volumes but also extraction (drilling and completions), production and export. It is hence time for drilling to become part of business units in an organization instead of being a service unit.

Continued failure to change the approach to drilling challenges will only extend the compromised project objectives despite the advances in technology and operating practices. With the emerging strategies and technologies, there is a great opportunity for oil and gas companies today to create a futuristic organization that involves drilling as a business unit. This will not only enhance the overall business risk management but also improve operating standards, maximize value, minimize costs and reduce risk.

Hence, drilling must be considered as a business unit in an organization's culture and not as a service unit.

5.0 Conclusions and Recommendations

Fig. 2 provides an Advantage Matrix of Drilling as a Business Case.

Few major reasons for the industry's inability to resolve most of the conflicts discussed in this document are:

(a) inadequate appreciation and understanding that drilling has the largest permutations and combinations of uncertainties, non-linear and random risks as compared to other disciplines;

(b) treatment of drilling as a service unit and "Details" which creates limited boundary conditions towards technical execution and eliminates the opportunities to apply business principles;

(c) the challenges listed in **Section 4.0** above;

However, going into the future, drilling cannot be considered as a service unit as conventional approach to drilling will not deliver the full spectrum of objectives as depicted in **Fig. 1**.

By adapting drilling as a business unit, an oil and gas company will gain a holistic execution process from field acquisition until commercial monetization. It will also enhance an organization's as well as industry's credibility to the eyes of the world which is growing resistance to fossil fuel due to inappropriate and negative propaganda.

5.1 Recommendation to all Stakeholders

5.1.1 Drilling Competence Person Report (DCPR) – Recommendation to all Stakeholders

A Drilling Competent Person Report (DCPR) is recommended to all the stakeholders including but not limited to corporate leadership, board and management, lenders, investors, banks and regulatory to ensure that the field development and monetization including 1st oil or commercial production schedule envisaged by subsurface, reservoir engineering and finance is feasible and practical.

The Author has developed a unique model for Drilling Competent Person Report (DCPR). The DCPR will also enhance the value of a Well Examination Certificate (WEC) that is needed in some countries to obtain drilling permit and OEE insurance etc by validating the prudence, compliance, and conformance.

5.1.2 Drilling Performance Confidence Matrix (DPCM) Classification System

Similar to the **SPE's Reserves Classification Table,** a **Drilling Performance Confidence Matrix (DPCM) Classification System** has been developed by the Author. The DPCM Model will be presented as a separate document. Only the outline of the DPCM Model is given below as reference:

(1) The DPCM Table is divided into Three Major Categories – (1) Field Acquisition/Exploration/Appraisal Wells, (2) FDP-Field Monetization Plans and (3) Development Wells.

(2) In the order of increasing risk and complexity, the Performance Confidence is categorized at three levels for each of the Major Category.

(3) The criteria for Confidence Matrix with impact on cost is defined for each Major Category.

This DPCM and its principles will be extremely helpful to the industry and all the stakeholders.

5.1.3 Drilling MBA

With the advent of drilling as a business unit, a suitable platform is required to create the awareness and a roadmap to achieve the transition. The Author had developed an innovative learning model "**Drilling MBA**" to achieve this transition, first of its kind in the world, which is designed for not only drilling personnel but also for other disciplines, decision makers and senior management of an oil and gas organization that interfaces with drilling. This will create a new breed of engineers to execute drilling as a business unit.

5.1.4 Others

Establishing a futuristic drilling organization as a business unit requires radical changes to the traditional operating practices including but not limited to:

- ✓ coaching drilling personnel and decision makers on the transition of drilling as a business unit;
- ✓ extending drilling interface beyond subsurface or asset to all the relevant stakeholders;
- ✓ establishing drilling vs stakeholders' relationship with clearly defined engagement principles;
- ✓ develop executional models that allow drilling to work and deliver its business case to the stakeholders;

The Author has also developed short term courses for the effective application of this transition model.

6.0 Further Contacts:

For further discussions or presentations or materials, please contact:
jmk@iwellsmc.com
dcpr@iwellsmc.com

Website: www.iwellsmc.com

Disclaimer:

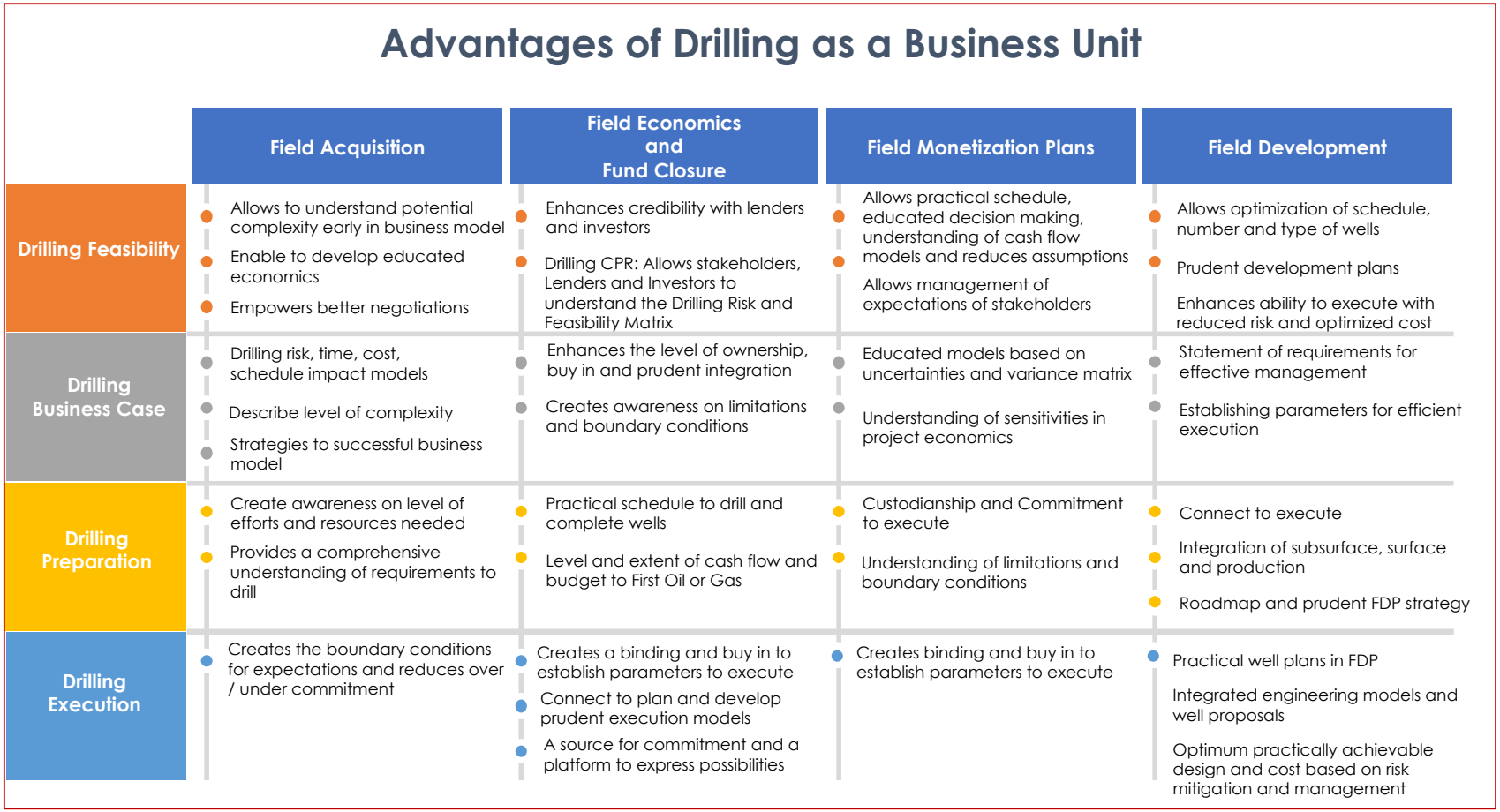

Fig. 2 - Advantage Matrix of Drilling as a Business Case