Four Emerging Supply Chain Themes for 2017

North American Shale

May 30, 2017
Introduction

Who is Oliver Wyman?

FUN FACTS

Global Management Consultancy

2016 Revenue: ~$1.6 Billion

Employees: ~3,500

Emerging Energy Vertical (~100)

Strong Horizontal SC Practice (~250)
Recap: What is Shale?
A technology play intended to exploit hydrocarbon bearing rock which is otherwise too impermeable to permit flow

Conventional Play

Unconventional Play

The simple idea is that if you don’t have a reservoir, you make one

Source(s): US DOE (images)
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NA Shale – Getting to Materiality

Back in mid-2014, while production was substantial, NA Shale was still a marginal supply option, with a full cycle cost of ~USD 70-80/bbl …

Global Liquids Supply Curve, Circa mid-2014

Cost: $USD/BOE vs Production: MMBOE/d

… back then, Shales future was uncertain
NA Shale – The Impetus
As everyone knows, oil prices crashed in late 2014 and have reset at roughly half their previous levels

WTI Oil Price
$USD/BBL

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Necessity has been the mother of invention – with productivities compounding, delivering orders of magnitude improvement

**Incremental Oil Production per Rig**
Barrels/day, per rig month (Average rig)

- **Bakken** Example/Proxy

> > 35% CAGR

~10% CAGR
NA Shale – Response (2/2)
NA Shale is now the lowest cost incremental supply option & will dominate the near term future of the global Oil & Gas industry

Global Incremental Crude Supply Curve, 2017
Cost: $USD/BOE vs Production: MMBOE/d

Source(s): May 2017 Energy Teach In – Morgan Stanley
© Oliver Wyman
NA Shale – Materiality
It represents an unprecedented production change; in North America or anywhere else

US & Canada: Gas Production
Bcf/d

US & Canada: Oil Production
MMbbl/d

Last 10 years ~ $1.5 Trillion in investment, Last 5 years – NA Shale has satisfied all incremental global oil demand
NA Shale - How did we get here?
We got better at virtually every step in the Supply Chain (innovation, efficiency)

Shale Program: Sequence of Activities

Surface & Leasing Permits
- Landman

Environmental and Regulatory Approvals
- Environmental service companies

Seismic and Geotechnical Surveys
- Seismic surveyors
- Consulting engineers
- Geologists
- Geophysicists

Land Surveys
- Land survey engineers

Site Preparation
- Heavy construction companies
- Trucking
- Logging services
- Rig move providers
- Water suppliers
- Conductor hole drilling contractor

Drilling
- Drilling contractor
- Bit supplier
- Drilling mud services
- Solids control equipment rental
- Directional drilling services
- Drilling waste management services
- Communications equipment supplier
- Top drive suppliers
- Trucking (pipe, mud, chemicals, rig move, heavy equipment)

Completions
- Services rig contractor
- Casing and tubing supplier
- Cement services
- Packer and service tool supplier
- Wellhead and valve supplier
- Vacuum truck
- Wireline
- Perforating

Fracturing
- Pressure pumpers
- Trucking (Sand, Water)
- Coiled tubing or service rig provider
- Chemical supplier
- Downhole tools provider
- Production testing and flowback services
- Waste water management

Fracturing
- Artificial lift supplier
- Storage tank suppliers
- Surface facilities suppliers
- Line heaters
- Separators
- Heater/Treaters
- Gas scrubbers
- Sweetening systems
- Flaring systems
- Compressors
- Booster compressors
- LACT transfer units

Transportation
- Truck; pipelines; rail
- Flowline installers

Matinence
- Service rigs
- Downhole tool suppliers
- Re-fracturing crews
- Mobile welding services
- Chemical suppliers

Well No. 1 – Location 1
Well No. 2 – Location 2
NA Shale – How its changing the Supply Chain conversation
Shale isn’t simply about exploiting unconventional reservoirs – it’s about
exploiting reservoirs in a very different way, relative to the ‘norm’

Key Elements of the Supply Chain Conversation … … and How this changes with Shale

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Conventional</th>
<th>Shale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Cycle</td>
<td>Annual</td>
<td>Rolling semi-annual</td>
</tr>
<tr>
<td>Execution Adjustments</td>
<td>Semi-Annual</td>
<td>Monthly</td>
</tr>
<tr>
<td>Design &amp; Equipment Standards</td>
<td>Annual (best)</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Work scale/scope</td>
<td>Steady state/ mature</td>
<td>Evolving/ – nascent process</td>
</tr>
<tr>
<td>Supplier Ecosystem</td>
<td>Well known, mature</td>
<td>Evolving</td>
</tr>
<tr>
<td>Contract Strategy</td>
<td>Full outsource; bundled pricing</td>
<td>Partial outsource; partial unbundling</td>
</tr>
<tr>
<td>Contractor Interaction</td>
<td>Transactional</td>
<td>Selective partnering</td>
</tr>
<tr>
<td>Internal Expectation</td>
<td>Manage contracts; share risk, not gain</td>
<td>Deliver value; share risk with intent to share gain</td>
</tr>
</tbody>
</table>
NA Shale – Four Emerging Themes
We are beginning to see four overlapping themes emerge in our conversations with Operators and Suppliers

<table>
<thead>
<tr>
<th>Theme</th>
<th>Key Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Vertical Integration (going into business against my suppliers)</td>
<td>Where to integrate and how much of internal demand/basin to integrate</td>
</tr>
<tr>
<td>Character of Strategic Relationships (How can greater joint value be extracted)</td>
<td>Materiality, degree of joint innovation, degree of joint planning Gain/value/risk sharing magnitude, gain/value/risk sharing process, tenure (when to revisit),</td>
</tr>
<tr>
<td>What to Commoditize</td>
<td>Impact on suppliers, impact on technology development</td>
</tr>
<tr>
<td>Price Risk Management</td>
<td>“Buy Side” cost management through contract and/or synthetic instruments</td>
</tr>
</tbody>
</table>

These themes are not new to Supply Chain, but how we handle them now is becoming quite novel
Theme 1: Vertical Integration
Where and how can “Insourcing” (1980’s), be best utilized to drive long term value

Notional Framework

<table>
<thead>
<tr>
<th>Category</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTSOURCE</td>
<td>- To use internal supply option(s) to control and/or modulate external market pricing for outsourcing the same spend</td>
</tr>
<tr>
<td>INSOURCE</td>
<td>- Drives strong savings in overheated markets</td>
</tr>
<tr>
<td></td>
<td>- Often protects schedule, which can be as important as cost</td>
</tr>
</tbody>
</table>

Advantages
- Typically undercapitalized, so need to avoid areas where innovation is required. In trouble if holding assets through disruptive technology change
- ‘Hostage’ to internal demand

Encana: Sand Example

- Build end to end supply chain
- Own and/or control key management points, notably contracts and pricing
- Self-manage logistics/schedule (joint planning)
- It does not constitute all of their sand demand

... it is an increasingly prevalent tool used by independent Shale players
Theme 2: Strategic Relationships
How can risk transfer create value for all involved?

“Old” Deal Framework

<table>
<thead>
<tr>
<th>Operator</th>
<th>OFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>Quality</td>
</tr>
<tr>
<td></td>
<td>Schedule</td>
</tr>
<tr>
<td></td>
<td>Risk</td>
</tr>
<tr>
<td></td>
<td>Logistics</td>
</tr>
</tbody>
</table>

Materiality | Safety

“New” Deal Framework

<table>
<thead>
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<th>Operator</th>
<th>OFS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Continuous Improvement</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
</tr>
<tr>
<td></td>
<td>Schedule</td>
</tr>
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Increased Mobility
Design Flexibility
Volume Flexibility

Success stems from Strong Management

• Implementation issues around CI, especially as you span multiple basins
• “New” deals drive a much greater resource need – from both parties, both in quantity and quality
• CI is never as smooth as the curves show, its experimental and will have setbacks
Theme 3: Commoditization
Careful what you commoditize – for nascent industries, these decisions could come back to haunt you

Play Type, Maturity versus OOIP
(% of OOIP Recovered, Years in Use)

Comments

- Commoditization is a standard outcome, absent other influences, of applying professional supply chain practices to spend categories
- However, Shale is in its relative infancy, with still some significant headroom to run before it approaches any reasonable level of maturity
- This would suggest that careful thought needs to be put into practices that will stress a supply chain caught in the flux of a developing technology
- The story of cement!
Theme 4: (Price) Risk Management
Where can hedging be applied on the Operators ‘buy’/ Services ‘sell’ side?

**Situation**

- Upstream firms take strong positions on whether to manage ‘sell side’ pricing, and if so, what to do
- Supply Chain manages price risk through contracts, but in times of great price stress, either up or down, these contracts tend to be renegotiated, undermining their original risk allocation
- OFS service (less so product) pricing is highly correlated to the price of oil and gas (R2 >0.80)
- Other important exposures playing into key cost inputs
  - Water
  - Iron ore
  - Labour
  - Logistics

**Discussion**

- Apparent mismatch on price risk with supplemental and/or complimentary positions which can be taken to mitigate buy side risks, independent of the contract
- Requires extending PRM capabilities to cover buy side activity, something most Marketing groups are relatively unfamiliar with
Closing Remarks
Now – more than ever, superior Supply Chain capability is becoming a critical enabler to competitive advantage

Simple Ideas
• Supply Chains deliver on needs. If needs are in flux, so is the supply chain
• Shale has different and evolving needs, to which supply chain professionals need to respond
• In an emerging technological context, its not always TCO that carries the day, but rather value creation – which requires space for innovation
• Moreso than ever, Shale is driving a need for senior supply chain professionals to manage complicated relationships in highly volatile contexts
• Those who do this well, can achieve a differentiated market position
THANK YOU