Capturing the Full Opportunity from Well Intervention in Today's North Sea

Dan Cole, McKinsey & Company

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Global upstream spending has started to increase

Quarterly capex
USD billion

Annual production cost
USD billion

Spending on wellwork has also started to increase

**Well maintenance spend**
USD billion

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>0.33</td>
<td>-0.31</td>
</tr>
<tr>
<td>2017</td>
<td>0.40</td>
<td>+0.07</td>
</tr>
</tbody>
</table>

+20%

**Well maintenance spend**
Share of overall opex

<table>
<thead>
<tr>
<th>Year</th>
<th>Share</th>
<th>Change</th>
</tr>
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<tbody>
<tr>
<td>2015</td>
<td>13.5%</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>7.8%</td>
<td>-5.7%</td>
</tr>
<tr>
<td>2017</td>
<td>8.7%</td>
<td>+0.9pp</td>
</tr>
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</table>

+0.9pp

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1 Data from 42 continuously participating offshore assets

Activity is also up (at least for some operators)

**Number of interventions**
Indexed to 100 in 2015

**Operator A**
- 2015: 100
- 2016: 164
- 2017: 244

**Operator B**
- 2015: 100
- 2016: 81
- 2017: 138

**Operator C**
- 2015: 100
- 2016: 133
- 2017: 83

With 1 in 8 wells currently shut-in, the opportunity for wellwork is vast

149 kboed

Additional production by restoring shut-in well % to the median level from the peer group

1. Data from 46 assets  2. Shut-in wells with potential: Shut-in wells capable of instant production or shut-in pending a workover  3. Other shut-in wells: Uneconomic or permanently shut-wells

A 100kbbl/d operator could generate ~$70-350mn in first year

<table>
<thead>
<tr>
<th>Well intervention</th>
<th>Additional recovery interventions</th>
<th>Gaps to industry benchmark</th>
<th>Potential incremental production, Kboe/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Under half of industry benchmark activity levels</td>
<td>3-7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower than industry benchmark success rate</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>Shut-in wells</td>
<td>• 10-20% more shut-in wells than benchmark</td>
<td></td>
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</table>

| Water injection | Reservoir management | • 25-50% lower waterflooding uptime than benchmark | 1-2                                      |
|                 | Ratio of water injection volume to production | • Lower VRR than waterflooded fields in industry benchmark | 2-5                                      |
| Field re-development | Number of wells per barrel of reserves | • 20-50% fewer wells per reserves volume than industry benchmark | 2-5                                      |

$70-350 m
Total value in first year

1 Assume the operator’s daily production increases by 5%-15% from a starting production of 100 kb/d, oil price $ 50/barrel

SOURCE: McKinsey Energy Insights Well & Reservoir Management Benchmark
Successful wellwork requires a combination of 3 elements

Successful wellwork requires a combination of 3 elements

- Planning
- Execution
- Organisation

Field Development & Operations Plan
Business Planning
Metering & Surveillance
Well Optimisation
Reservoir Management
Performance Management

Range of industry responses

Performance Bands

Source: McKinsey Energy Insights 2018 Wellwork and Reservoir Management practices assessment, covering 16 operators & 4 service companies
Teams that perform better on these dimensions deliver higher production from wellwork

Score on Energy Insights WRM practices assessment

<table>
<thead>
<tr>
<th>Planning</th>
<th>Execution</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5</td>
<td>0 1 2 3 4 5</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>2.9</td>
<td>2.6</td>
<td>3.1</td>
</tr>
<tr>
<td>3.5</td>
<td>3.6</td>
<td>3.3</td>
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Incremental production from well interventions


Team B: 13p.p.

Planning: Flexibility and prioritisation

Prioritisation, processes and tools to support:
- Leadership prioritisation of WRM activities
- Identification of high-value jobs
- Flexible budget allocation
- Best practices transfer

Good practice example of wellwork & reservoir management intervention funnel – with success measures at each step

<table>
<thead>
<tr>
<th>Success measure</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<tr>
<td>Data acquisition</td>
<td>Surveillance, well tests and meters</td>
<td>Opportunity identification &amp; management</td>
<td>Proposals internal + partner approvals</td>
<td>Execution planning</td>
<td>Execution</td>
<td>Performance monitoring</td>
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<td>Surveillance, well tests and meters</td>
<td>Opportunity registers and reviews</td>
<td>Effective budgeting and spending</td>
<td>Integrated activity planning</td>
<td>KPIs and performance dialogs</td>
<td>Planned vs. actual results</td>
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### Success measure

**A. Surveillance, well tests and meters**
- Over 90% of surveillance and over 95% of testing programs executed to plan
- Over 95% of meters functioning and calibrated

**B. Opportunity registers and reviews**
- Global opportunity register
- Owned by assets
- Generated by interdisciplinary team
- Used to build budget
- No shortage of NPV-positive opportunities

**C. Effective budgeting and spending**
- Sufficient resources for WRM activities in assets
- Guidelines to do all the work available at or below an agreed cost per barrel (e.g. $10/barrel)
- Assets have the mandate over WRM OPEX

**D. Integrated activity planning**
- Budget, long-term and short-term plans, operations and WRM plans are aligned
- Plans owned by both Well Interventions + Operations teams

**E. KPIs and performance dialogs**
- Consistent tracking of indicators at a global level by job type
- Rigorous asset health check periodically

**F. Planned vs. actual results**
- +/-5% match between planned and actual production #s
- Rigorous tracking of production contribution to WRM

Organisation: Responsibility and clear targets

Prioritisation, processes and tools to support:
- Leadership prioritisation of WRM activities
- Identification of high-value jobs
- Flexible budget allocation
- Best practices transfer

Organisational structure to facilitate:
- Clear responsibility for WRM
- Asset team shares WRM KPIs and targets
- Sufficient resources for WRM
- Supply chain integration into opportunity management
- Attractive career opportunities for WRM teams

Organisation set-up is a choice with pros and cons

**Position within the organisation**

**Within individual BUs**
- BU
- WRM
- BU
- WRM
- BU
- WRM

**As a function**
- BU
- BU
- BU
- BU
- WRM

**As a service provider**
- BU
- BU
- BU
- WRM

**Pros**
- Tailored approach
- Increased wellwork priority
- Central organisation applying shared standards & processes

**Cons**
- No standardisation
- No practice sharing
- No common mindset
- Collaboration & prioritisation
- Needs pull from BU leadership
- Challenge to understand & priorities locally

Execution: A focus on the 3-12 month execution window

Prioritisation, processes and tools to support:
- Leadership prioritisation of WRM activities
- Identification of high-value jobs
- Flexible budget allocation
- Speed of wellwork execution

Organisational structure to facilitate:
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Execution excellence in the 3-12 month window:
- Single owner from concept to execution
- Flexible process allowing speed up of high impact, low risk opportunities
- Wide opportunity set

A case example

“We know that WRM are the cheapest barrels, so it has the largest support”

“If the opportunity is significant, the budget is available”

“Monthly reviews... to trigger management intervention”

A case example

“We know that WRM are the cheapest barrels, so it has the largest support”

Planning

“If the opportunity is significant, the budget is available”

Execution

Organisation

“Monthly reviews… to trigger management intervention”

120%
boost in production contribution
- More production-enhancing well interventions
- Proactive interventions and reduced failures

50%
less well related production deferments

100%
increase in optimisation wellwork

We work with operators to identify actions and practices to maximise value from well intervention.

**Quantify value**

1. **Value**
   - Incremental production
   - Protected volumes
   - Incremental profit
   - Return on investment

2. **Activity And Spend Levels**
   - Number of interventions
   - Mix of interventions
   - Cost of intervention
   - Cost per incremental/protected barrel

3. **Job Execution Excellence**
   - Job success rate
   - NPT as a % of actual time
   - Actual/AFE cost
   - Actual/planned time
   - Actual/planned inc. prod.
   - TRIR
   - Time by activity

**Link to the best practices**

**Planning**
- Policies, processes and tools support:
  - Identification of high-value jobs
  - Flexible budget allocation
  - Speed of wellwork execution

**Organisation**
- Clear responsibility for WRM
- Asset team shares WRM KPIs and targets
- Sufficient resources for WRM
- Supply chain integration into opportunity management
- Attractive career opportunities for WRM teams

**Execution**
- Single owner from concept to execution
- Flexible process allowing speed up of high impact, low risk opportunities
- Wide opportunity set
- There is rigorous performance benchmarking

Our team has a strong blend of wellwork & reservoir experience
McKinsey Energy Insights is a part of McKinsey Ventures, combining over 90 years of expertise with the entrepreneurship of a start-up.

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1 Energy Consulting ranking, Vault survey (annual survey of consultants on the best consulting firms), McKinsey ranked no. 1 since 2006