Well Delivery Process
A Proven Method to Improve Value and Performance While Reducing Costs.
IADC/SPE 128716

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To day I will cover the following

- Purpose of a WDP
- Stage Gate Processes
- Distinction of type of operations
- Overview of WDP
- Key tools for WDP
- Lessons learned from application
- Success factors
Well Delivery traditionally called a process

- Process is a series of actions directed to some end (ref. flowchart)
  - the completion of a well for data acquisition or hydrocarbon production.

- But it is a system ……
Characteristics of a System

- **Defn:** Set of detailed methods, procedures and routines established or formulated to carry out a specific activity

- **Structure**
  - defined by parts and their composition;

- **Behavior**
  - which involves inputs, processing and outputs of information, energy and material;

- **Interconnectivity**
  - the various parts of a system have working as well as structural relationships between each other.
The purpose of the WDP is to:

- Maximize the value of a well
- Minimize the risk in constructing and operating the well
- Align goals through the value chain
- Gain multidisciplinary input
  - internal and external to the organization
- Optimize the front end workload
- Deliver reduced & predictable costs
The WDP is managed through stage gates

- Define the stages
  - Usually matched to Capital Value or Opportunity Realization process

- Balance the stages
  - Sufficient for the decision or action

- Define the gates
  - Deliverables
  - Approvals
## Typical WDP Stages

<table>
<thead>
<tr>
<th>Identification &amp; Assessment</th>
<th>Evaluation &amp; Selection</th>
<th>Planning &amp; Procurement</th>
<th>Execution</th>
<th>Hand Over / Close Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will we undertake it?</td>
<td>What will we undertake?</td>
<td>How will we undertake it?</td>
<td>Undertake it.</td>
<td>How did we undertake it?</td>
</tr>
<tr>
<td>Risk &amp; Uncertainty</td>
<td>Major risks &amp; uncertainties</td>
<td>Narrowed options, Critical early decisions</td>
<td>Risks addressed, contingencies planned</td>
<td>Discipline to manage against plan and contingencies</td>
</tr>
<tr>
<td>Design and program</td>
<td>Concepts</td>
<td>Selected design</td>
<td>Detailed design</td>
<td>Execution program</td>
</tr>
<tr>
<td>Other aspects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost range</td>
<td>+50% to −30%</td>
<td>+25% to -15%</td>
<td>Budget +15% to −10% AFE +10% to −5%</td>
<td>Actual</td>
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</table>
**Definition of the stage gates is critical**

Deliverables, forward plan, decision criteria

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Overview

The diagram illustrates the relationship between cost influence and risk and uncertainty across different WDP stages. The graph is divided into high and low ranges, with cost influence and cost expenditure plotted on the axes. The stages of WDP include:

- Identification and Assessment
- Evaluation and Selection
- Planning and Procurement
- Execution
- Hand over and Close Out

The graph shows how risk and uncertainty decrease as the stages progress, with cost influence and expenditure being key factors to consider.
It is very important to distinguish types of operations

- **Projects**
  - Non repetitive with unique goal

- **Ongoing business**
  - Repeated processes to deliver products and services
  - Multiple types
<table>
<thead>
<tr>
<th>Features of different types of ongoing business</th>
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<tbody>
<tr>
<td><img src="image" alt="Table" /></td>
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<td>Description</td>
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<td>Standardized</td>
<td>Highly standardized</td>
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<tr>
<td>Advantages</td>
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**Factory Drilling**
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**Desired transition**

**Reduced stages of WDP, less detail of WDP, shorter planning duration**
Revised well design, increased uncertainty sub surface

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**Increased stages of WDP, more detail of WDP, longer planning duration**

**Desired transition**
There is an industry trend that enables transition to repetitive operations

Reducing uncertainty sub surface
Key WDP Tools

• Risk and Uncertainty management
  – Qualitative – identification and ranking
  – Quantitative - modeling
  – SPE 97269
An example of a risk assessment matrix

<table>
<thead>
<tr>
<th>HSE</th>
<th>Schedule</th>
<th>Capital cost</th>
<th>Operating cost</th>
<th>Functionality</th>
<th>Production</th>
<th>Reputation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatality or serious permanent injury</td>
<td>1 week</td>
<td>$1 mill</td>
<td>Loss of &gt;50%</td>
<td>PI Reduction 50%</td>
<td>Prosecution</td>
<td>Possible loss of operating license</td>
</tr>
<tr>
<td>Serious injury</td>
<td>1 day</td>
<td>$100,000</td>
<td>Loss of 10 to 50%</td>
<td>PI Reduction 25%</td>
<td>Regulator involvement</td>
<td>10</td>
</tr>
<tr>
<td>Lost Time Incident</td>
<td>6 hours</td>
<td>$25,000</td>
<td>Loss of &lt;10%</td>
<td>PI Reduction 10%</td>
<td>Complaints from local community</td>
<td>5</td>
</tr>
<tr>
<td>First Aid</td>
<td>1 hour</td>
<td>$5,000</td>
<td>Little impact</td>
<td>Little impact</td>
<td>Little impact</td>
<td>1</td>
</tr>
</tbody>
</table>

Probability / Frequency

- > 5 years
- 1 year
- 6 months
- < 14 days

- < 5%
- 5 - 25%
- 25 - 50%
- > 50%
<table>
<thead>
<tr>
<th>Risk ID</th>
<th>Project sub group</th>
<th>Project phase</th>
<th>Description of event</th>
<th>Description of cause</th>
<th>Risk or Uncertainty</th>
<th>Impact type</th>
<th>Impact rating</th>
<th>Probability rating</th>
<th>Risk rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proj Specification</td>
<td>NAPIMS approval later than scheduled</td>
<td>Delays beyond expected duration</td>
<td>Risk</td>
<td>Schedule</td>
<td>25</td>
<td>3</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Poorly understood process requirement</td>
<td>Uncertainty of process rate and stream conditions is interpreted as changes in design parameter</td>
<td>Uncertainty</td>
<td>Functionality</td>
<td>10</td>
<td>4</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Work not completed according to schedule</td>
<td>Resources assigned late, insufficient resources assigned</td>
<td>Risk</td>
<td>Schedule</td>
<td>25</td>
<td>4</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Subsurface</td>
<td>Proj Specification</td>
<td>Gas volumes are larger than base case used in FEED</td>
<td>Oron production</td>
<td>Uncertainty</td>
<td>Functionality</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Subsurface</td>
<td>Proj Specification</td>
<td>Gas volumes are larger than base case used in FEED</td>
<td>Additional upside production</td>
<td>Uncertainty</td>
<td>Functionality</td>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Facilities</td>
<td>Proj Specification</td>
<td>Current structures unable to take additional loads of risers, etc</td>
<td>Structures inadequate for additional use</td>
<td>Risk</td>
<td>Capital cost</td>
<td>10</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Facilities</td>
<td>Proj Specification</td>
<td>Loss of oil production</td>
<td>Shut down required for interfacing the CPU 2 to current production</td>
<td>Risk</td>
<td>Production</td>
<td>10</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>Facilities</td>
<td>Proj Specification</td>
<td>Insufficient reserves to meet sales contract</td>
<td>Non associated gas less than expected</td>
<td></td>
<td></td>
<td></td>
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- **Risk identifier**
- **Project phase**
- **Risk event**
- **Risk cause**
- **Estimate of risk probability (from the matrix)**
- **Estimate of risk impact**
- **Identification of type of impact**
  - (safety, cost (opex / capex), schedule, functionality)
- **Risk ownership**
- **Mitigation actions**
  - Plan it out, develop contingency
- **Cost / benefit of mitigation**
- **Timing of mitigation**
Key WDP Tools

• Detailed scheduling
  – Planning and preparation activities
  – Linked schedules with lead times
  – Detailed – 1000 vs. 40 activities
  – Daily update, auto look ahead

• Technical Limit Process
  – Addresses Invisible Lost Time (+NPT)
  – Early stretch goals (BHAG’s)
  – Schedule, functionality and cost
Key WDP Tools

• Probabilistic cost estimating
  – Risks / uncertainties in schedule & cost model
  – “S” curve – shows range of costs
  – Tornado diagram – ranking uncertainties
“S” curves enable visual comparison of mean cost / time vs. spread

Comparison Of Well Cost Using WBM to OBM

WBM, Mean = 11.2 MM$

OBM, Mean = 11.1 MM$

Well Cost [MM$]
Tornado diagrams rank the drivers of uncertainty in cost / schedule

- Tar sub salt – contingency expandable casing string
- Bit runs – more or less trips
- Waiting on Weather
- Mud cost – less losses
- xxxxx
- yyy

Range – duration, cost
Key WDP Tools

- Simulation / Table top exercises
  - DWOP / CWOP / TWOP / …..
  - Minimize critical path time
    » Essentially rotary table
- Optimize preparation
- Minimize risks
  » Full identification
  » Manage, mitigate
- Gain ownership in the plan
  » Input from all sources
Some of the Lessons Learned

• Arbitrary 10% contingency is without foundation

• Inadequate and poor tools:
  – DWOP is just a 2 hr presentation
  – Over application distributions = central limit theory
  – Risk ranking illogical

• Poor application of tools
  – Risk log dormant
  – Skipped risk log because supervisor felt it was routine

• Failure to listen
  – Ignore the input from suppliers
Some of the Lessons Learned

- Inadequate time to plan
  – Compressed drilling sequence led to operational failure

- Failure to maintain WDP integrity
  – Take short cuts
  – Failure to audit application

- Lack of management commitment
  – Unable to invest in planning time and effort

- Check lists are ‘tick the box”

- Failure to correlate to type of operation
Application benefits (detriment)

- West Africa - marginal fields / complex wells:
  - Best in Class industry benchmark
  - NPT from 33% to 7%

- Two cases poor application:
  - Performance vs. benchmark dropped (2x)
WDP success factors

- Well defined and relevant to end user
  - Built in house rather than copied from outside
- Leadership drives implementation
  - Discipline to manage the gates
- Process tools are carefully selected & applied
- Scalable application (adjusts to operation)
  - Large effort for Project type wells
  - Lower effort for Repetitive type wells
  - Scale the use of tools
    » New risks vs. routine risks
  - Maintain rigor
- Benchmark performance
  - Ascertain and monitor results
Identification & Assessment
Evaluation & Selection
Planning & Procurement
Execution
Hand Over / Close Out

Well Delivery Process - Stages

Project
Exploration & Appraisal Wells
Redesigned Wells

Ongoing Business
Development Wells
Job Shop
Batch
Repetitive
Infill Wells
Groups of wells
Identical Wells

Range of Types of Operations

Project
Ongoing Business

Well Delivery Process - Stages
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**Range of Types of Operations**

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**Execution**
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The Well Delivery Process

Thank You

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