



# SWORDS

Automated Analytic Solution for  
Well Opportunity Identification



S P E E D



A C C U R A C Y

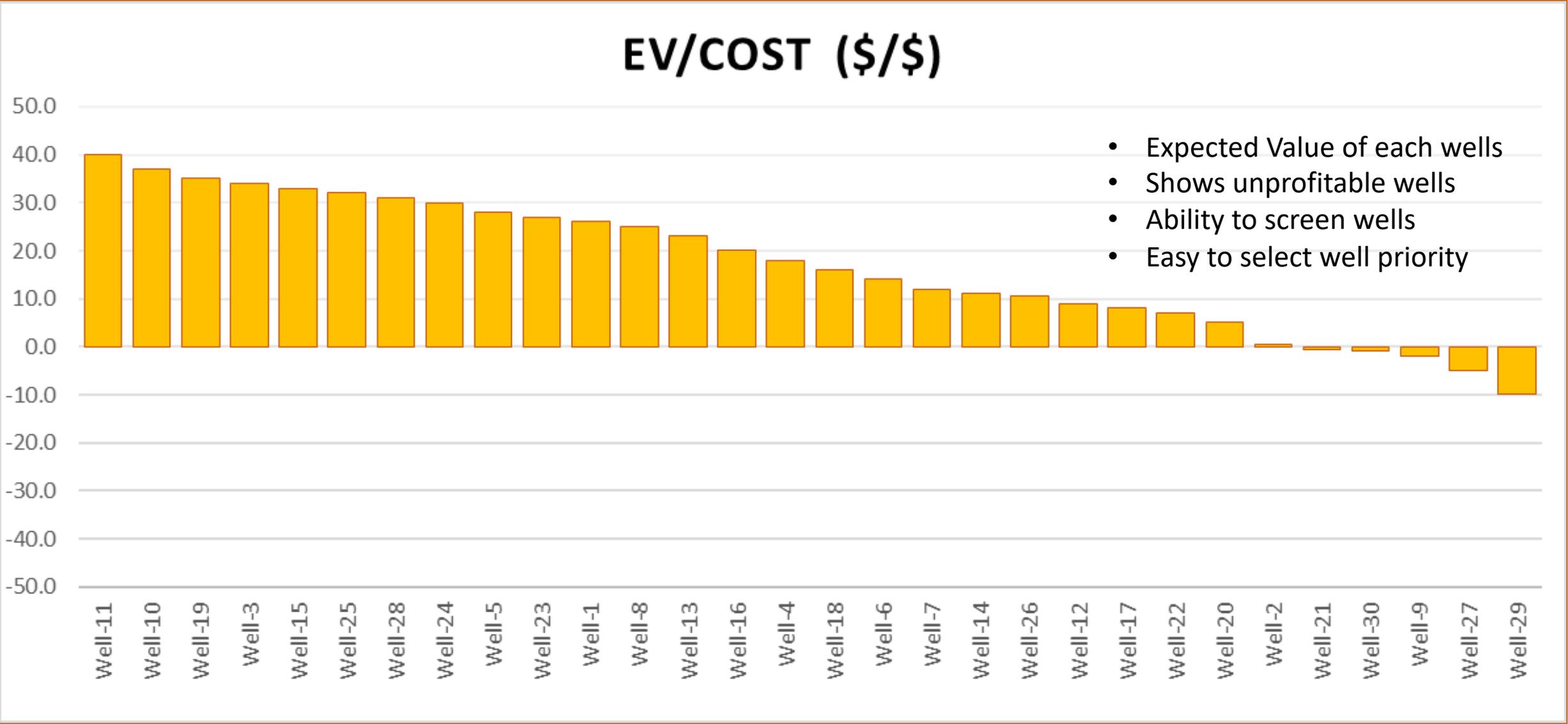


D E C I S I O N

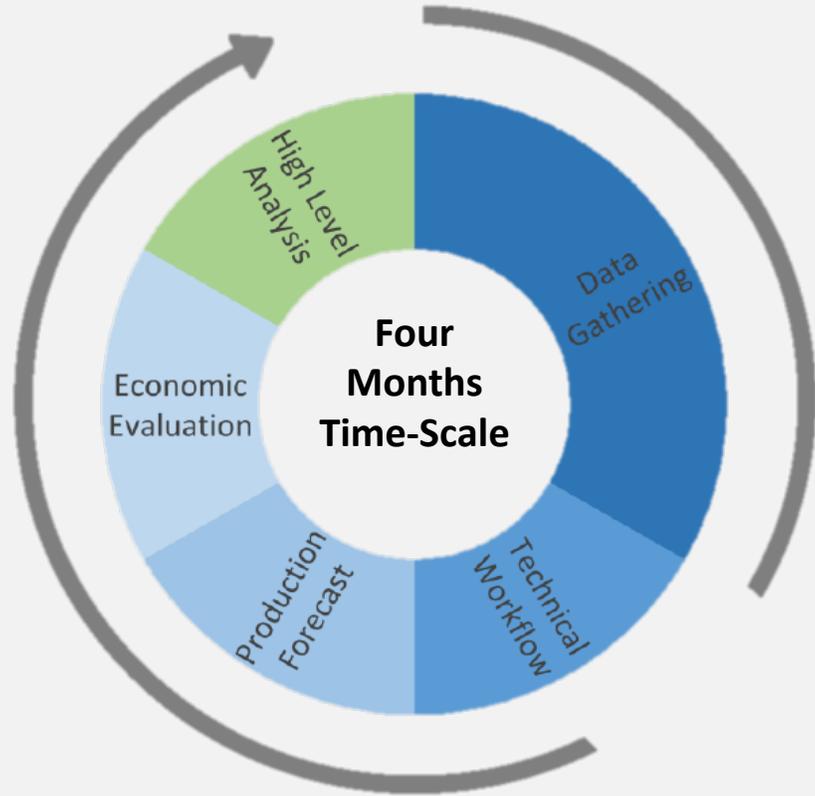
**Ameria Eviany**

Production Engineer | Saka Energi Indonesia

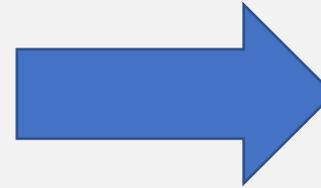
# Well Portofolio



# Conventional Process



# SWORDS



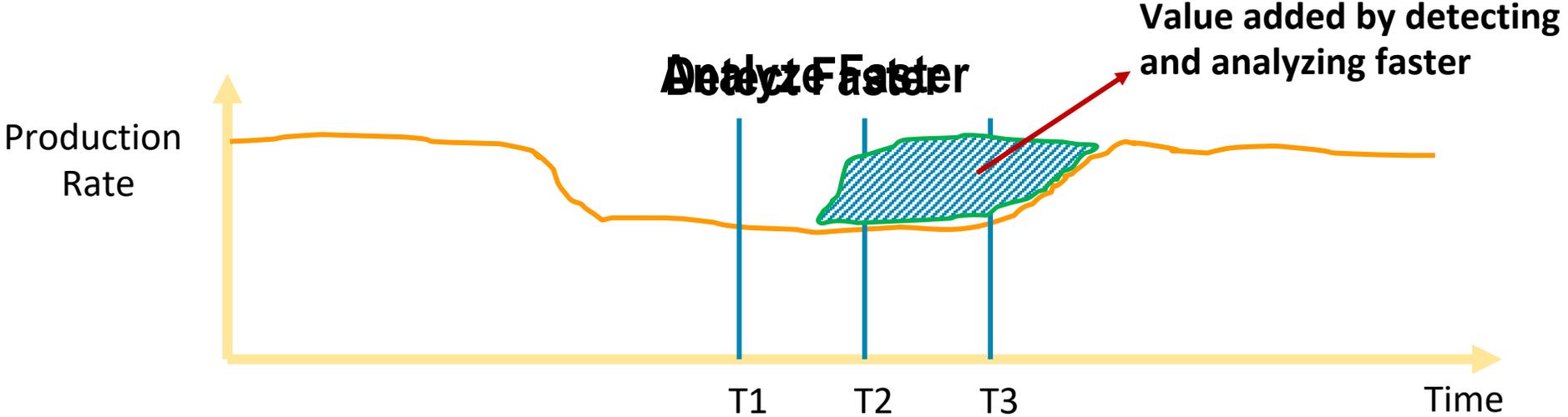
**1 week  
Time-Scale**

**SAVING:**

**193 K\$** per year head cost

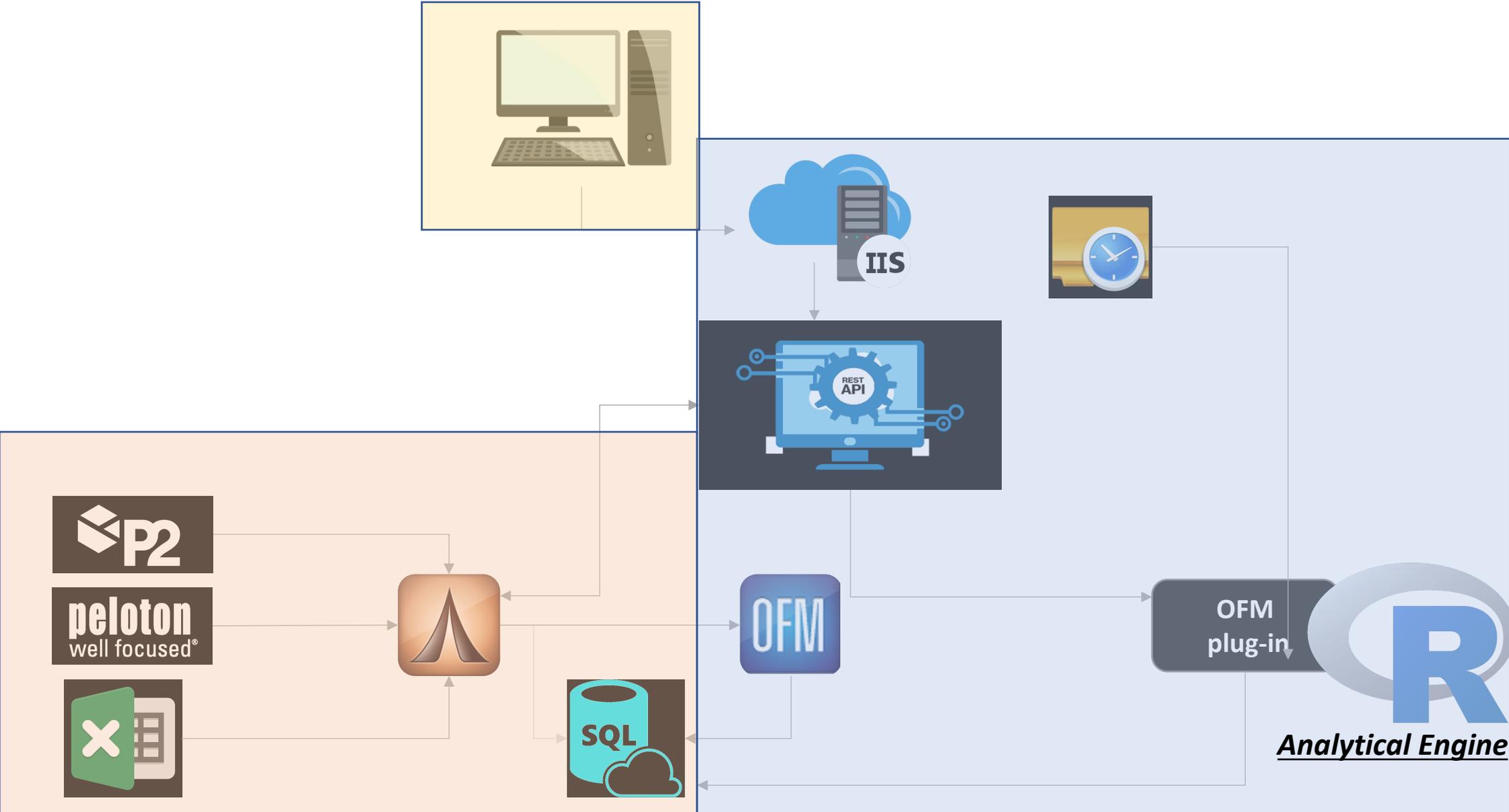
**94% of time** for well review process

# Where is the value added?

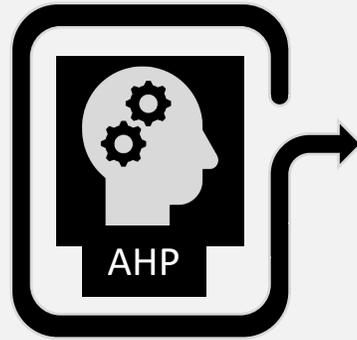


- T1 = Time to **Detect** the event
- T2 = Time to **Analyze** and **Diagnose** the event
- T3 = Time to **Take actions**

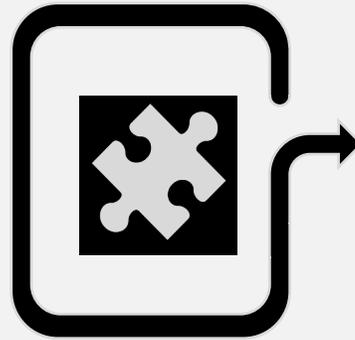
# Interoperability Framework



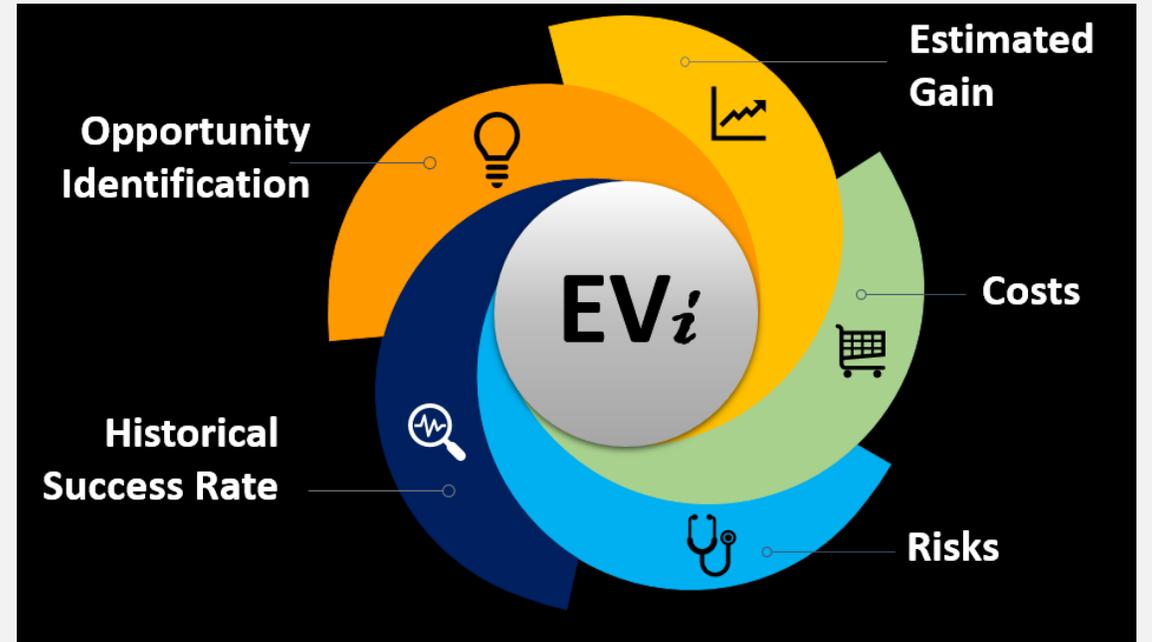
# Solution Approach | Process Flow



**ANALYTICS &  
RANKING**



**PROBLEM  
ANALYSIS**



**Knowledge Base**

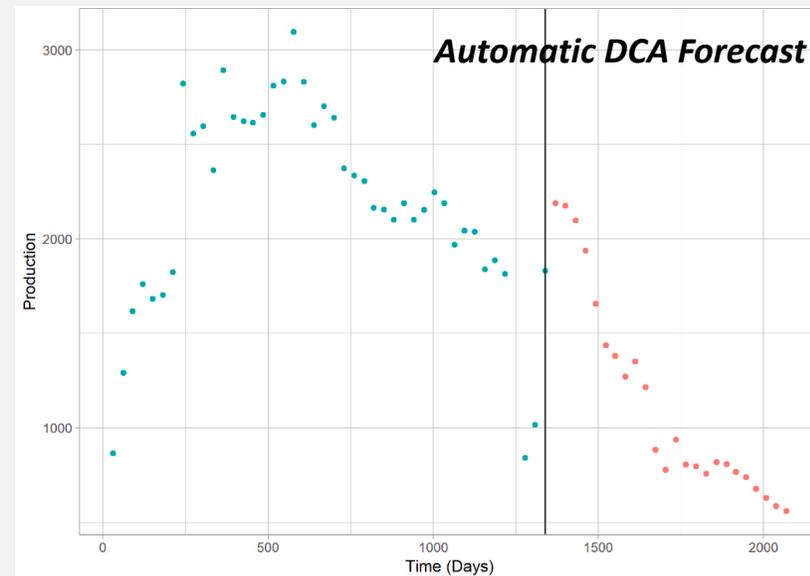
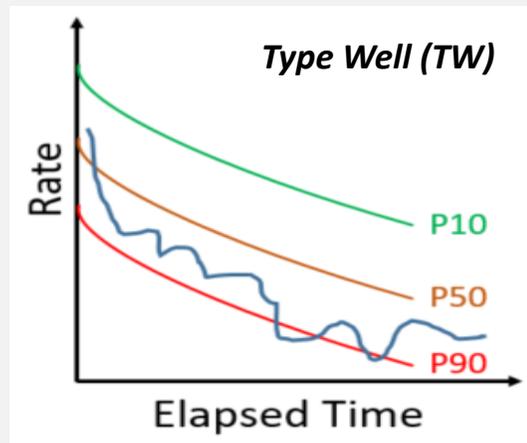
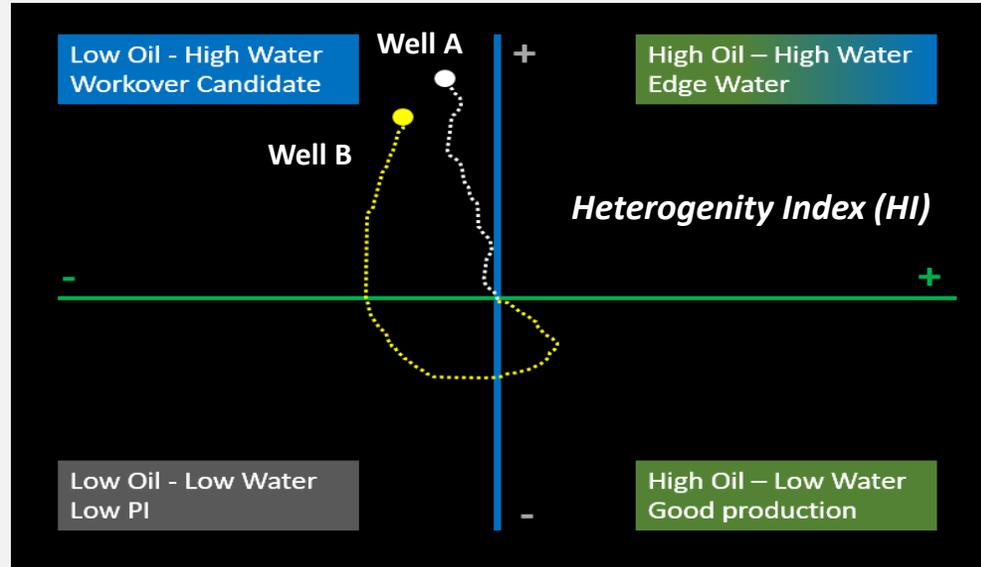
**Technical Analysis**

**Chance of Success**

**Economic Analysis**

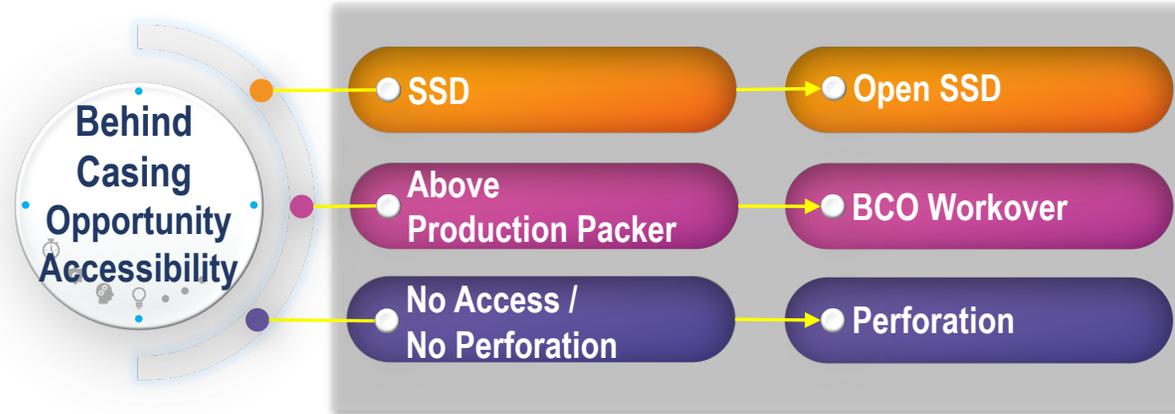
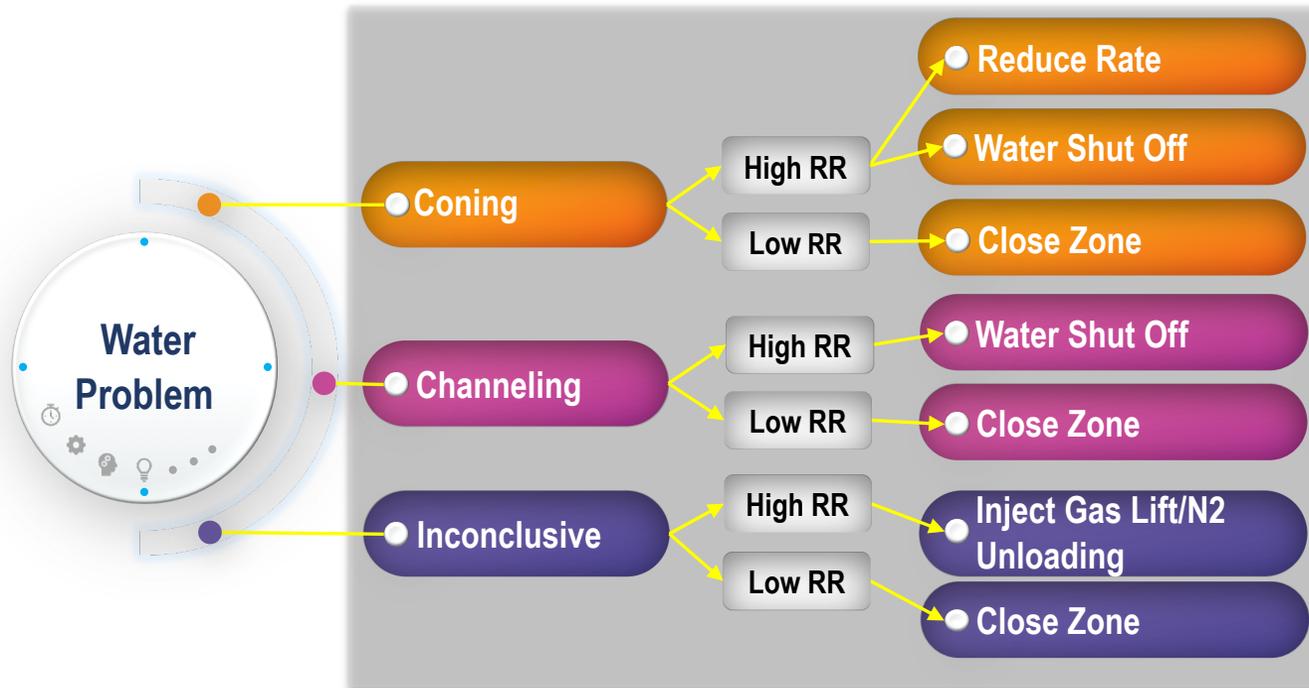
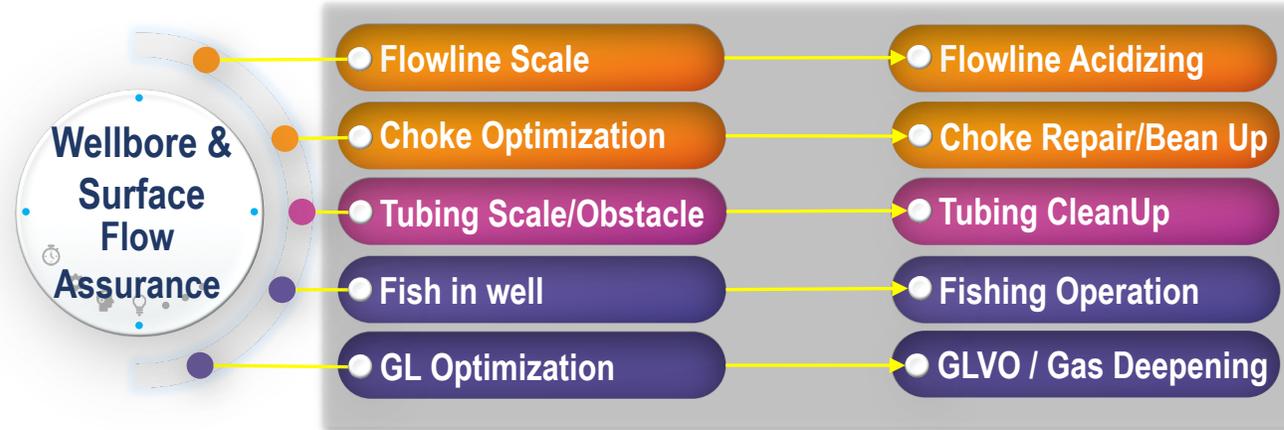
# Technical Analysis | Analytic Hierarchy Process (AHP)

	Weight
Identify Candidate Gas Wells	100.0%
<b>Well_Status</b>	70.1%
Status	56.1%
DSLIP	14.0%
<b>Performance</b>	20.2%
HI	8.7%
TW	8.7%
P50_last_3mo_diff	5.8%
P50_total_diff	2.9%
Areal	2.9%
<b>Potential</b>	9.7%
KH	5.7%
TP	2.7%
RR	1.3%



Well	Score
Well-11	3.4
Well-10	3.0
Well-19	3.0
Well-3	2.9
Well-15	2.8
Well-25	2.8
Well-28	2.8
Well-24	2.8
Well-5	2.7
Well-23	2.7
Well-1	2.6
Well-8	2.6
Well-13	2.6
Well-16	2.6
Well-4	2.5
Well-18	2.5
Well-6	2.4
Well-7	2.3
Well-14	2.3
Well-26	2.3
Well-12	2.2
Well-17	2.2
Well-22	2.2
Well-20	2.2
Well-2	2.1
Well-21	2.1
Well-30	2.1
Well-9	2.0
Well-27	1.9
Well-29	1.5

# Technical Analysis | Problem Analysis | Constrains & Opportunities



# Scale Problem | SIPOC Diagram

SCALE										
SOURCE		INPUT	PROCESS			OUTPUT				
(Application/ Database)	Data Source	Data Type	Condition/Check/Problem Signature			Process Result	Problem	Opportunity		
P2	Pressure Data	Downstream Flowline Pressure (X)	Is (X-A or B) >30 psi	YES		Scale in Flowline	SCALE	Flowline Acid & Soaking		
		Average Downstream Choke WHP-A Wells (A)	OR							
		Average Downstream Choke WHP-B Wells (B)								
		Well Head Pressure (Y)		Is (Z-Y) > 30 psi		NO	Is (Z-A or B) >30 psi		Choke Optimization or Repair Choke	Choke is not Optimum
		Upstream Choke (Z)								
WELLVIEW	Well Intervention Report	Scale Indication	If Scale Indication present in WI Report			Scale in Tubing	SCALE	Acidizing		
PROSPER	Well Model Matching		If Scale not present in WI Report			Not Scale Problem				

# Technical Analysis | Dashboard

Opportunity Evaluation    AHP Comparison    Diagnostic Plot    BCOs

## Recommend Interventions

Default    Save    Proceed

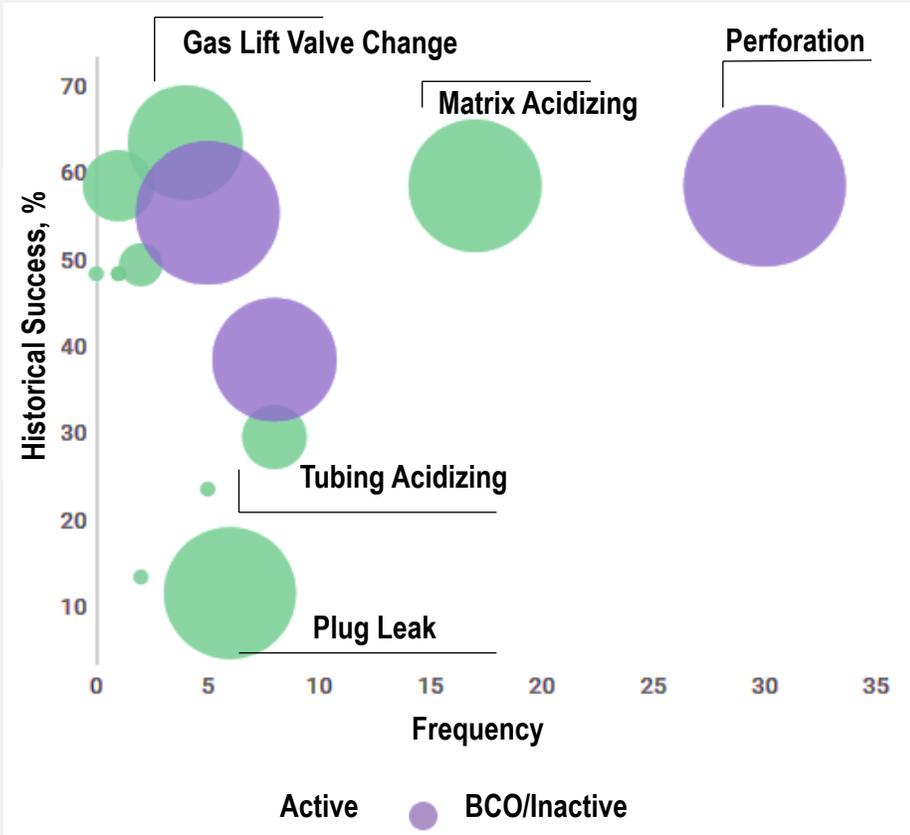
REVIEW	RANK	STRING	ZONE REVIEW	ZONE	STATUS	TECHNICAL POTENTIAL GAS mscf/day	TECHNICAL POTENTIAL OIL bbl/day	CONSTRAINTS	OPPORTUNITY	OPPORTUNITY REVIEWED	TP-GAS REVIEWED mscf/day	TP-OIL REVIEWED bbl/day	
<input checked="" type="checkbox"/>	1	WELL-F2	<input checked="" type="checkbox"/>	Z1	Active	3487.97	27.90						
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	Z2	BCO	1703.45	13.63	Production Packer	BCO_Workover	BCO_Workover	▼		
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	Z3	BCO	692.67	5.54	Production Packer	BCO_Workover	BCO_Workover	▼		
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	Z4	BCO	854.81	6.84	Production Packer	BCO_Workover	BCO_Workover	▼		
				WellBore					Flowline Scale	Flowline Acidizing	Flowline Acidizing, Tubing Clean...	▼	
						2393.67	19.15				2141.519	17.13215	
<input checked="" type="checkbox"/>	2	WELL-B6	<input checked="" type="checkbox"/>	Z1	Active	16.18	0.13	Gas Lift Constraint	Gas Lift Valve Change/Increase Gas Lift Rate	Gas Lift Valve Change/Increase ...	▼		
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	Z2	BCO	1334.51	10.68	NO ACCESS	BCO_Perforation	BCO_Perforation	▼		
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	Z3	BCO	790.84	6.33	NO ACCESS	BCO_Perforation	BCO_Perforation	▼		
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	Z4	BCO	252.14	2.02	NO ACCESS	BCO_Perforation	BCO_Perforation	▼		
		WellBore											

## Technical Screening

# Chance of Success | Historical Success & Risk Quantification

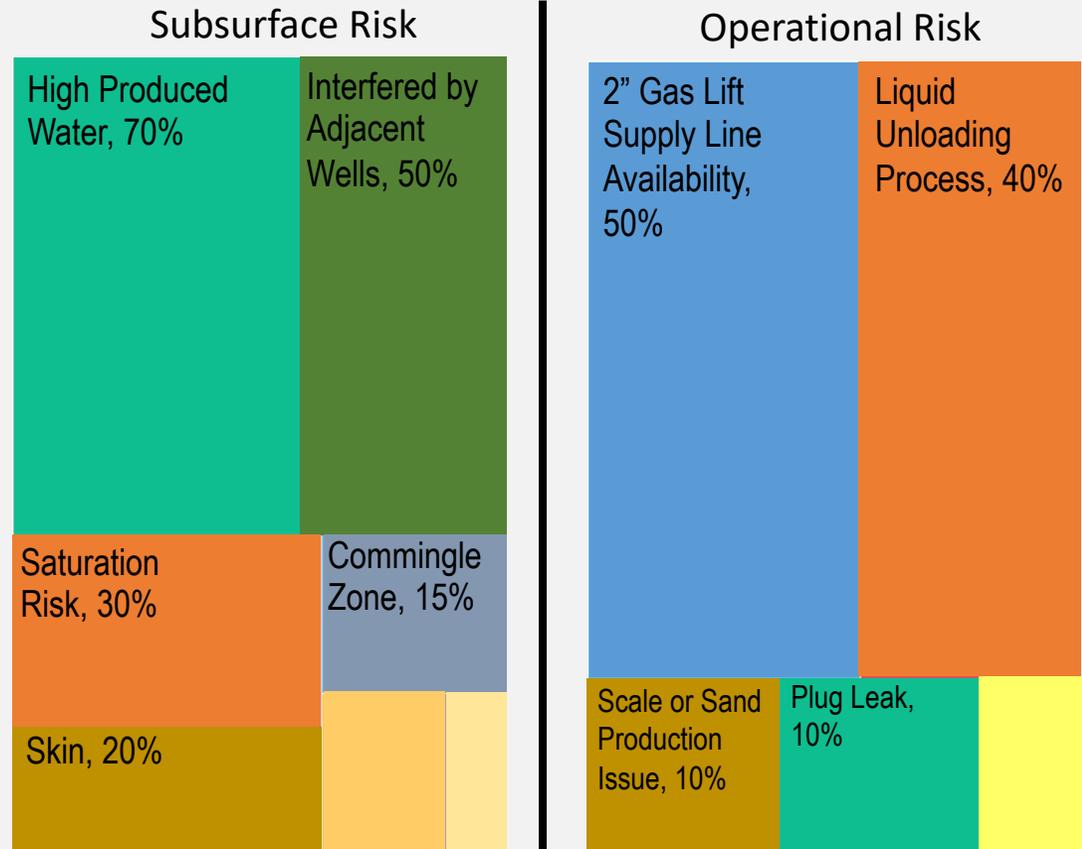
## Historical Success

- Field's Intervention History Study



## Risk Quantification

- Calculation of Subsurface and Operational Risk Factors



Knowledge Base

Technical Analysis

Chance of Success

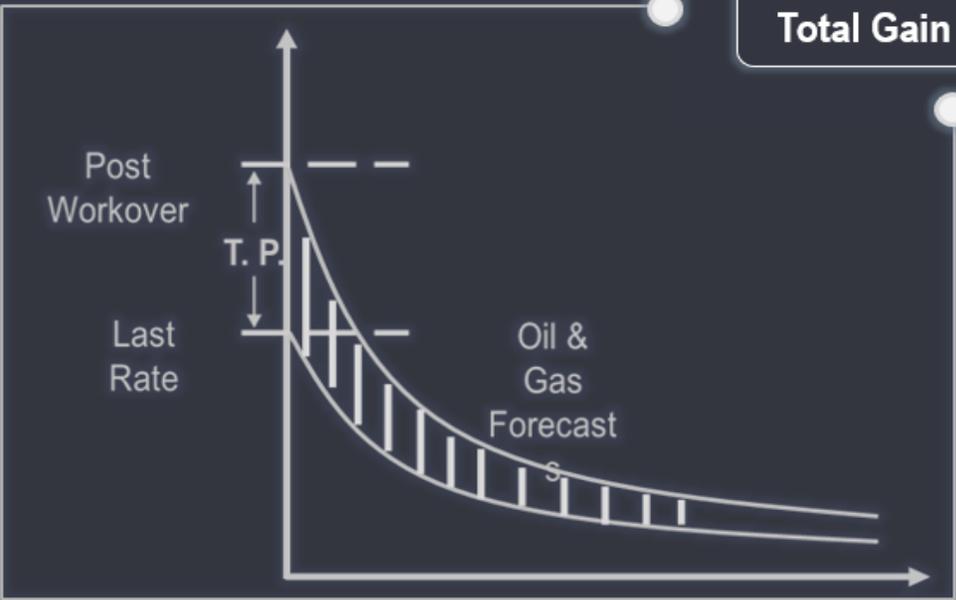
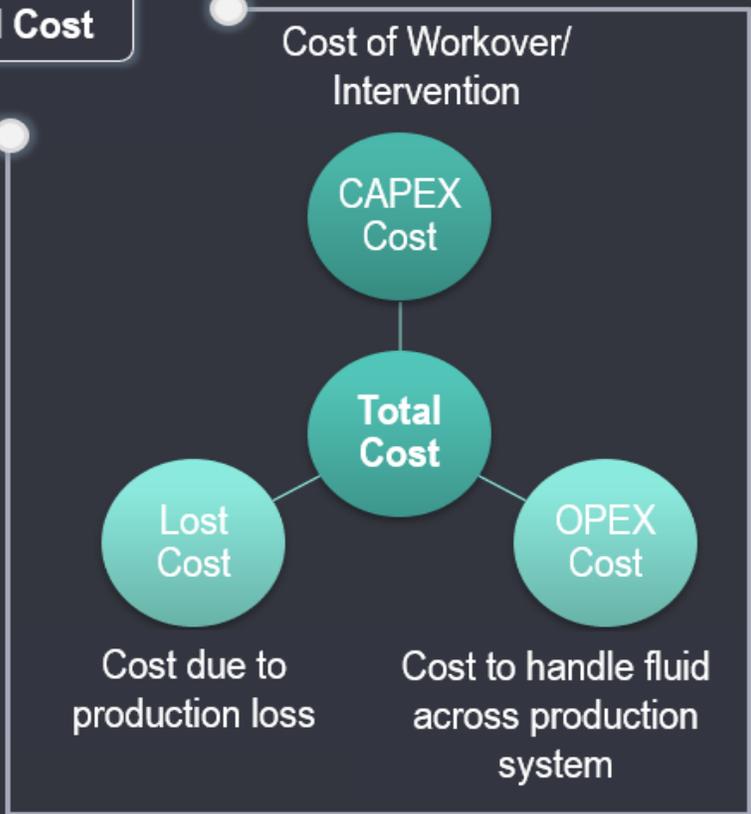
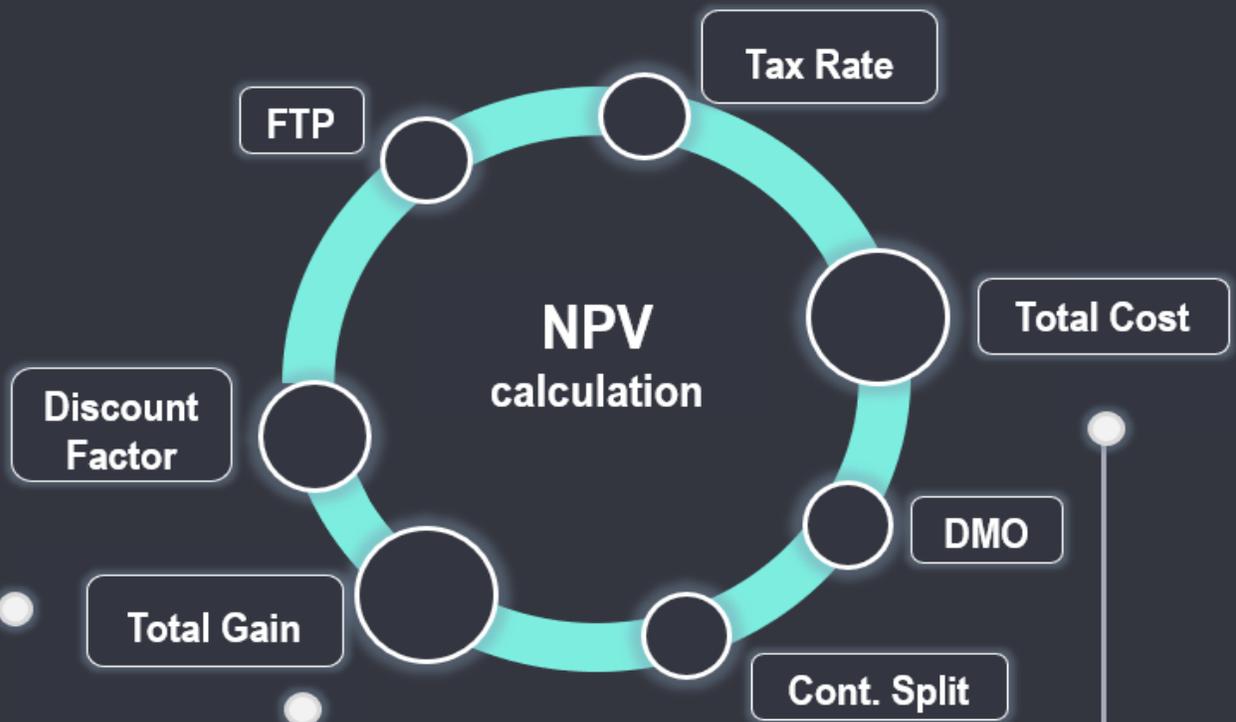
Economic Analysis

# Historical Success Rate & Risk Assessment | Queries

SAKA Activity	Estimate Execution Days	Estimate Cost	Target Gas Rate (MCF/day)	Target Oil Rate (bbl/day)	Incremental Gas Rate (MCF/day)	Incremental Oil Rate (bbl/day)	Gas-Historical Success	Oil-Historical Success	Number of Cases	Historical Success
Flowline Acidizing	3	10,000	1000	50	0	120	0%	100%	2	50%
Tubing Acidizing (Wellbore Clean out)	3	25,000	929	125	193	90	12%	50%	8	31%
Gas Lift Valve Change Out (GLVCO)	3	20,000	500		350		70%	50%	1	60%
Matrix Acidizing	5	80,000	1067	50	1207	71	52%	68%	17	60%
N2 Unloading	2	10,000	1000	25	0	10	0%	30%	2	15%
Perforation (BCO)	5	120,000	1458	130	1815	105	43%	76%	30	60%
Close Zone	3	20,000	1500	25	1250	10	25%	0%	6	13%
Open SSD (BCO)	3	20,000	1250	0	944	170	29%	50%	8	40%
Water Shut-Off (Squeeze of Chemical)	5	150,000	1200		0		0%	50%	5	25%
Fishing Job	10	100,000	1000	50	667	279	30%	100%	4	65%
Gas Lift Deepening	10	250,000					50%	50%		50%
Workover	14	3,000,000	680	243	1240	266	50%	63%	5	57%

Risk Category	Operational Risk Evaluation Queries	Weightage
Scale/ Sand Production Issue	1. Last HUD (Held up depth) from last Well Intervention is higher than top of perforation.	30%
	2. Do we have scale sample from previous intervention?	30%
	Is Well Header to Upstream Choke > 30 Psi: Last 3 days	20%
	For WHP-A, if Downstream Choke to MP Separator > 75 psi; For WHP-B, if dS Choke Pressure to MP Separator > 50 psi	20%

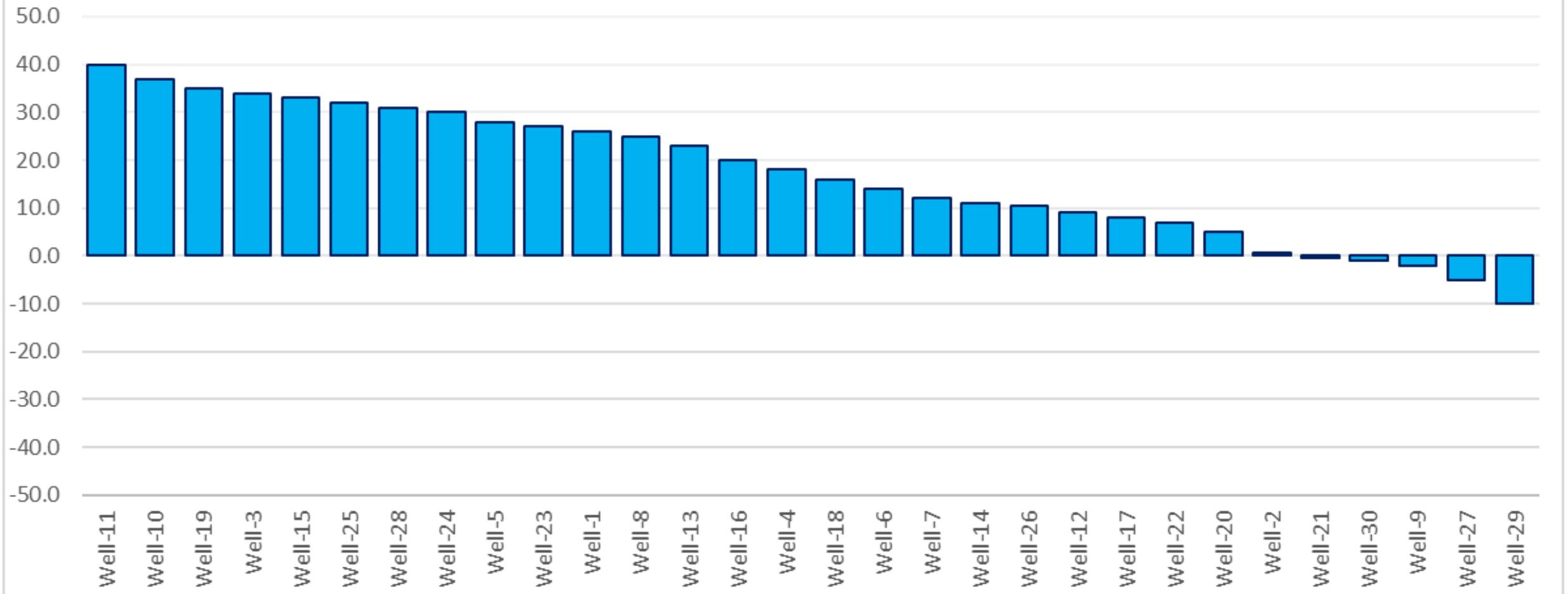
# NPV | Gain and Cost



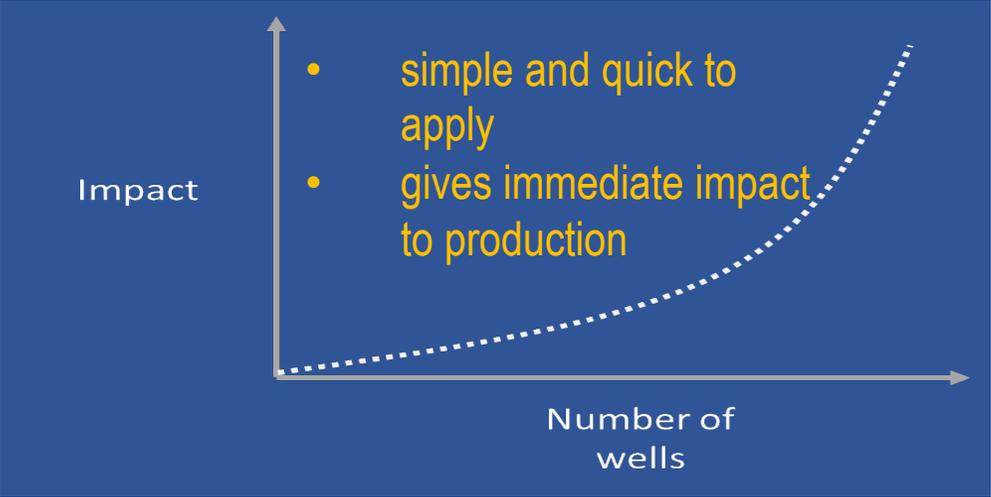
# Expected Value (EV)

$$EV = NPV_{(\text{gain \& costs})} * (1 - \text{Risks}) * \text{Historical Success}$$

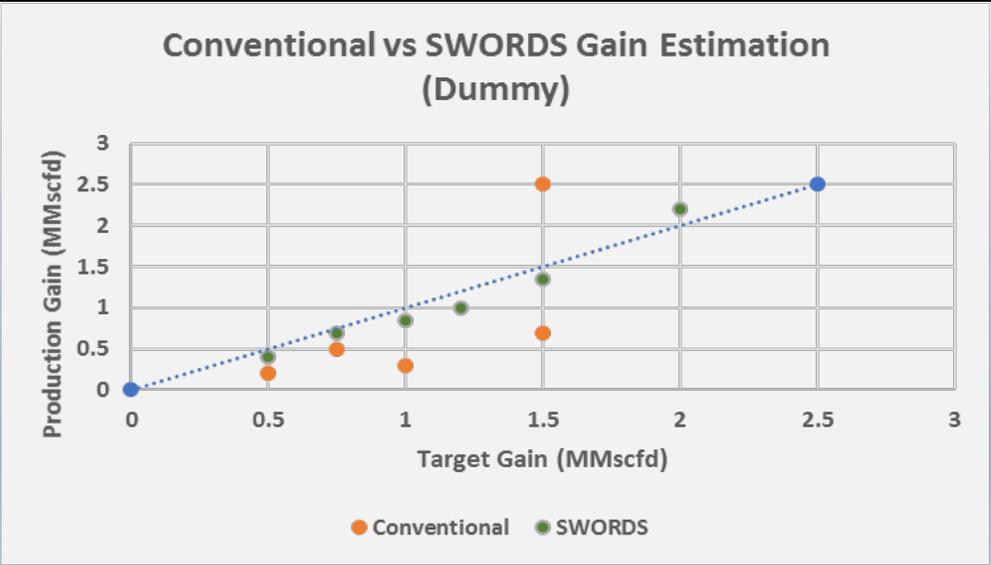
## EV/COST (\$/\$)



# Conclusion | Result



- ❖ Perform full well optimization, workover, and intervention candidate review across 196 completions within a week.
- ❖ Executed Swords results in 7 wells.
- ❖ Improved the decision making in term of speed and accuracy.



# Appreciation to

**pgn** SAKA  
*power to discover*

**Schlumberger**