Well Portfolio Optimization (**WPO**) deployment in CaspiNeft Kazakhstan

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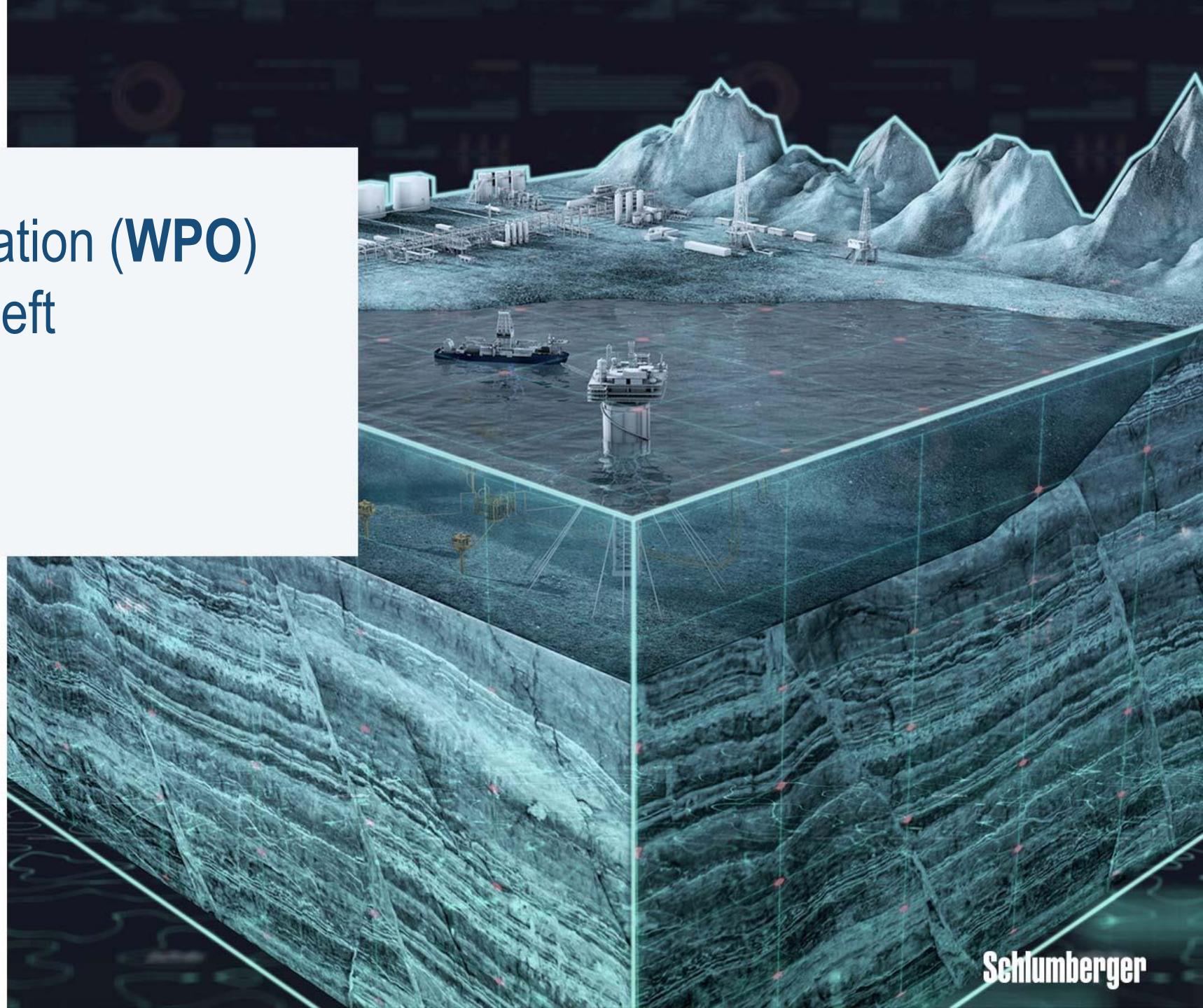
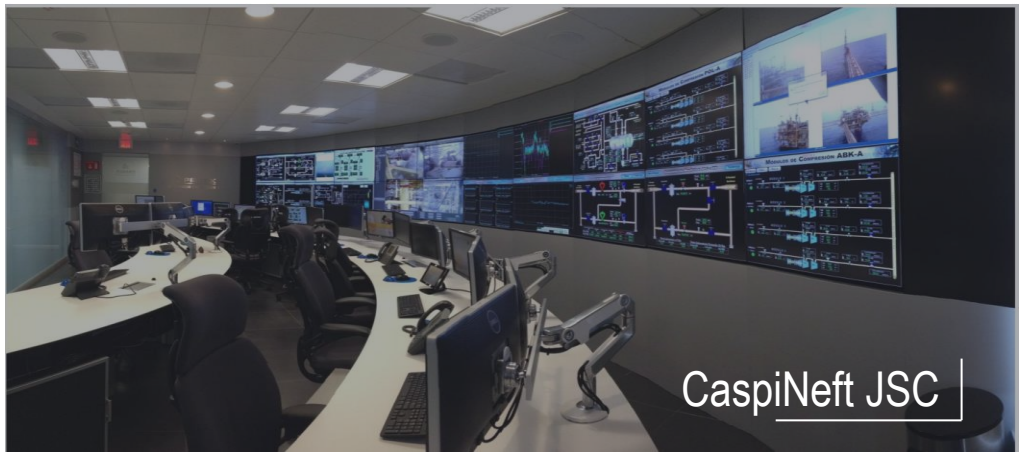


Content

About company and field



- **One the of biggest** Independents in West Kazakhstan
- Operates **Airankol oilfield**, located in Caspian region
- **Digital Oil Field (DOF)** implemented from 2020
- **WPO** deployed as part of DOF
- Has its own **geological, production department** and **several workover** teams with rigs

- Discovered in **1979**
- **Atyrau region**, Kazakhstan
- **2 domes (**East and West)
- **200** vertical wells
- **Depth** of reservoirs:
  - 610 - 910 m in Cretaceous
  - 1050 - 1500 m in Jurassic
- Production with **ESP, PCP, SRP**

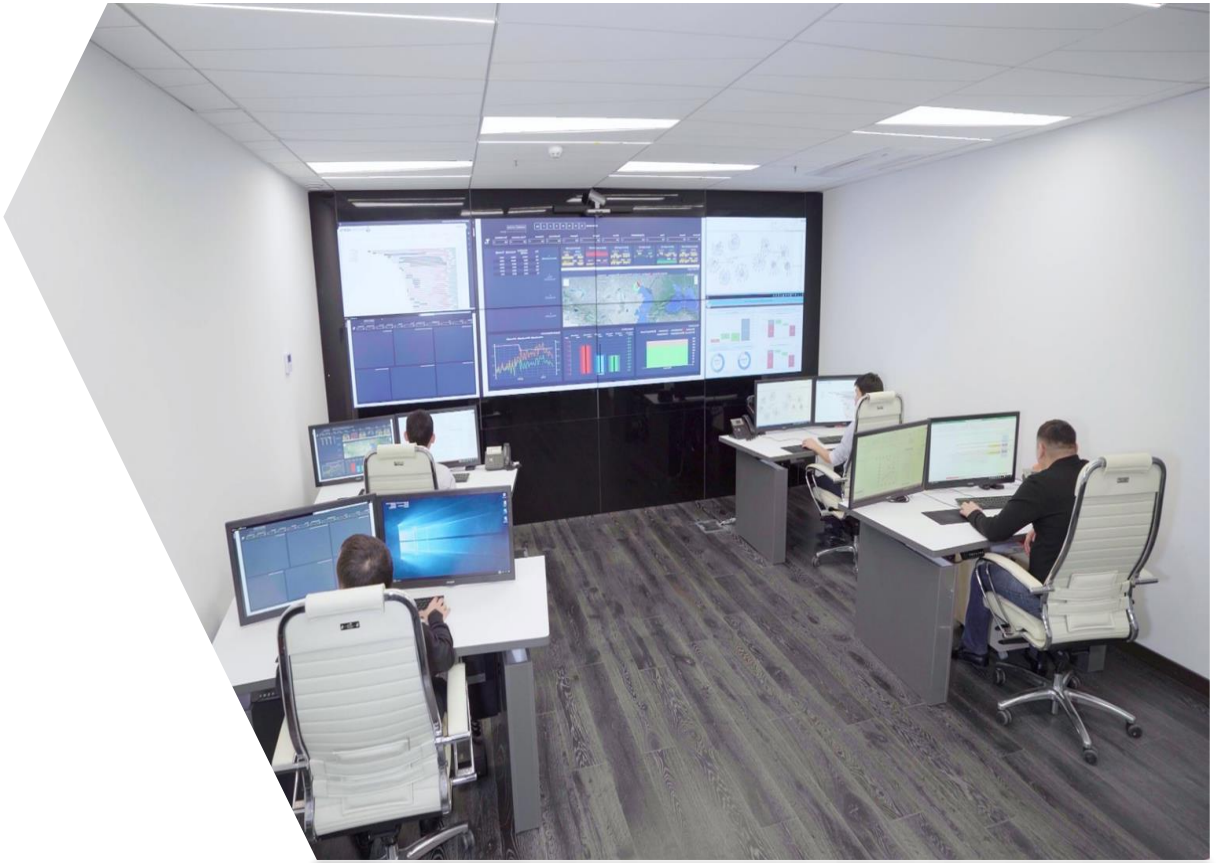
Project Motivation

Drivers

- Company has an ambition to grow as major independent regional player
- Transformation through digitalization and deployment of DOF

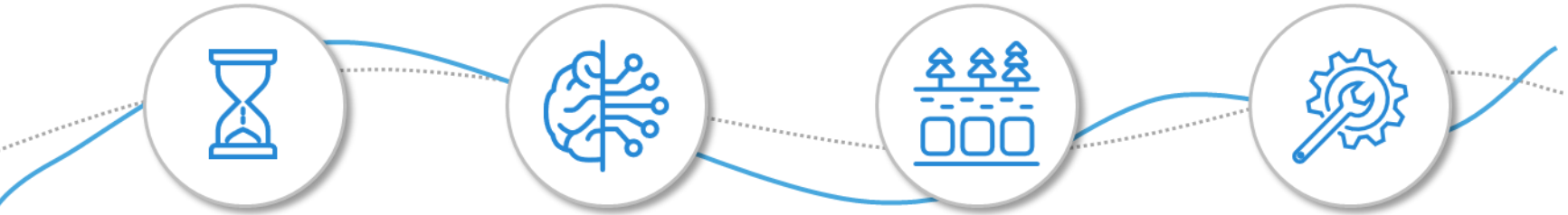
Strategic objectives

- Increase business and operational efficiency
- Reduce costs and maximize recovery
- Increase investment attractiveness of the asset in long term



Asset Problems and Challenges

CHALLENGES



TIME & RESOURCES

High-well count assets (200 wells)

Manual and tedious screening of intervention opportunities

DATA ANALYSIS

Different sources and type of data

Too many factors and criteria for manual analysis

Difficult to analyze existing data

RESERVOIR

Complicated reservoir with multizone structure

Required proper water and pressure management

WORKOVER PROGRAM

Active workover campaign

Growing number of problem wells and workovers

Two workover teams full utilized

PROBLEMS

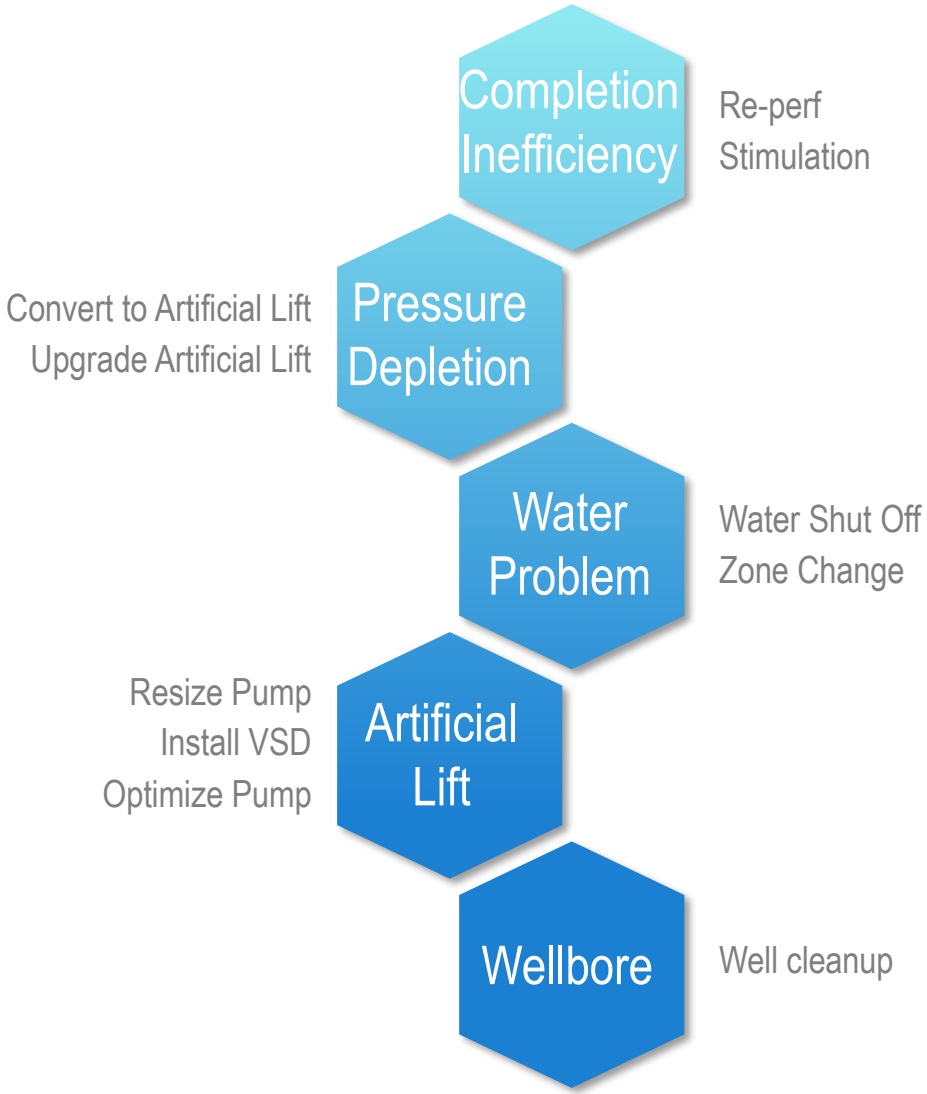
Decision quality suffers because not enough time & resources

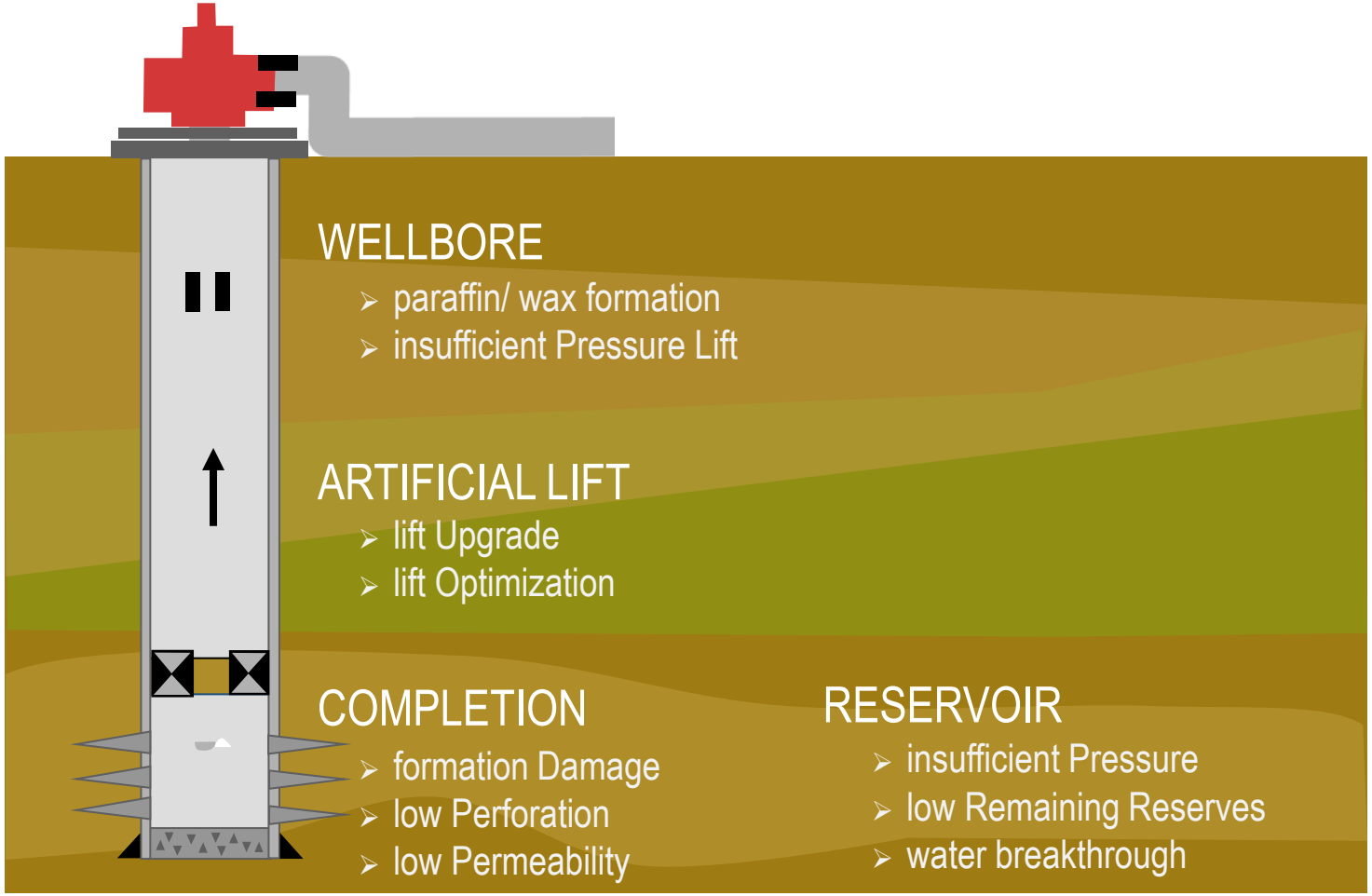
Unplanned stops are not analyzed systematically

No quantitatively analysis of lost production due to stops

Ineffective utilization of workover rigs and personal

Well Problems

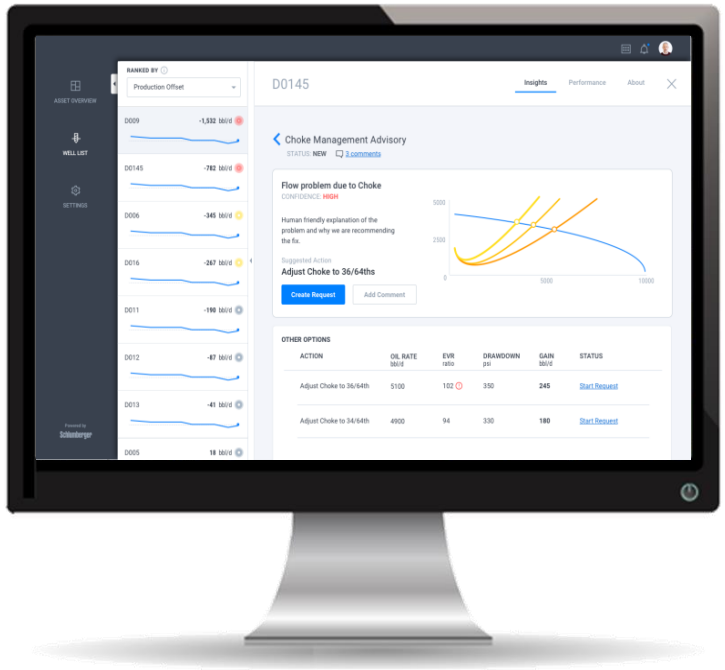




Different actions would impact well rate differently – some may reduce

Proposed solution: Well Portfolio Optimization (WPO)

Advisory System



Opportunities

- Increase Drawdown/ Upgrade Pump candidates
- Add Perforation candidates
- Reperforation/ Stimulation candidates
- Frac Stimulation Candidates
- Zone Change candidates
- Water Shut Off candidates
- Decrease Production candidates

Analytics components

- BHP & PI Modeling
- Automated production forecasting
- Chan analytics
- Analytic Hierarchy Process

Automation

Business Logic

Customized the solution

Solution design

Production Enhancement Wells

Performance

- Heterogeneity Analysis
- Type Well Analysis
- Areal Trends: WC/WGR

Potential

- Reserves
- Incremental Production
- Pressure
- Reservoir Quality Index

Root Cause Analysis

- Water Production Diagnostics
- Formation Damage Index
- Multi-dimensional HI Plots
- Artificial Lift Performance Trend Analysis
- Pressure Trend Analysis
- Recoverable Reserves
- Liquid production per perf pay
- Behind Casing Potentials
- Vertical Flow Barrier Analysis
- Distance to WOC

Interventions

- Zone Change
- Water Control
- Well Cleanups
- Stimulation
- Re-perforation
- Addition of Perforation
- Pump Upgrade
- Pump Optimization

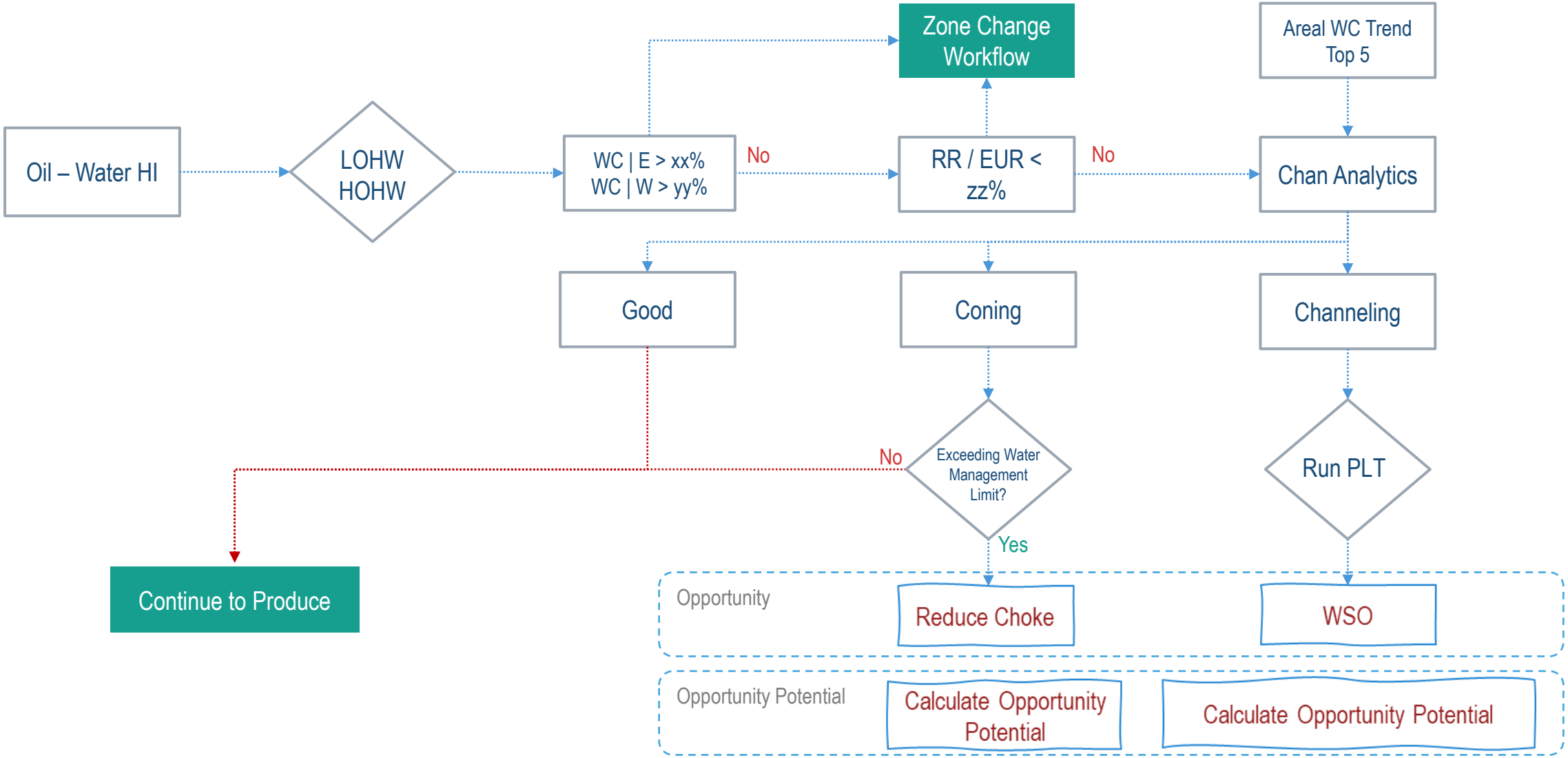
Quantify Gains

- Offset Well Performance
- Well PI Analysis
- Behind Casing Potentials

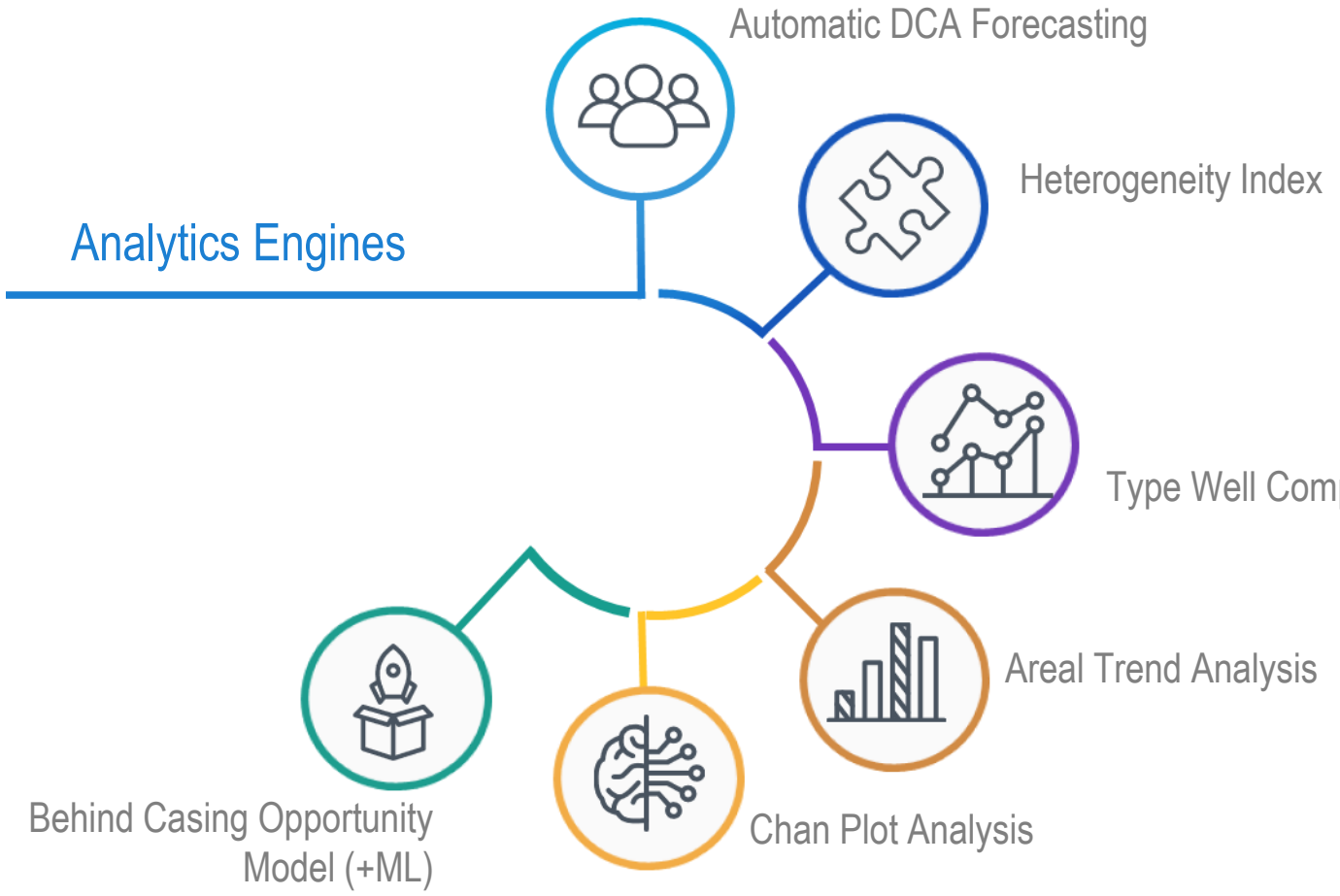
Prioritize

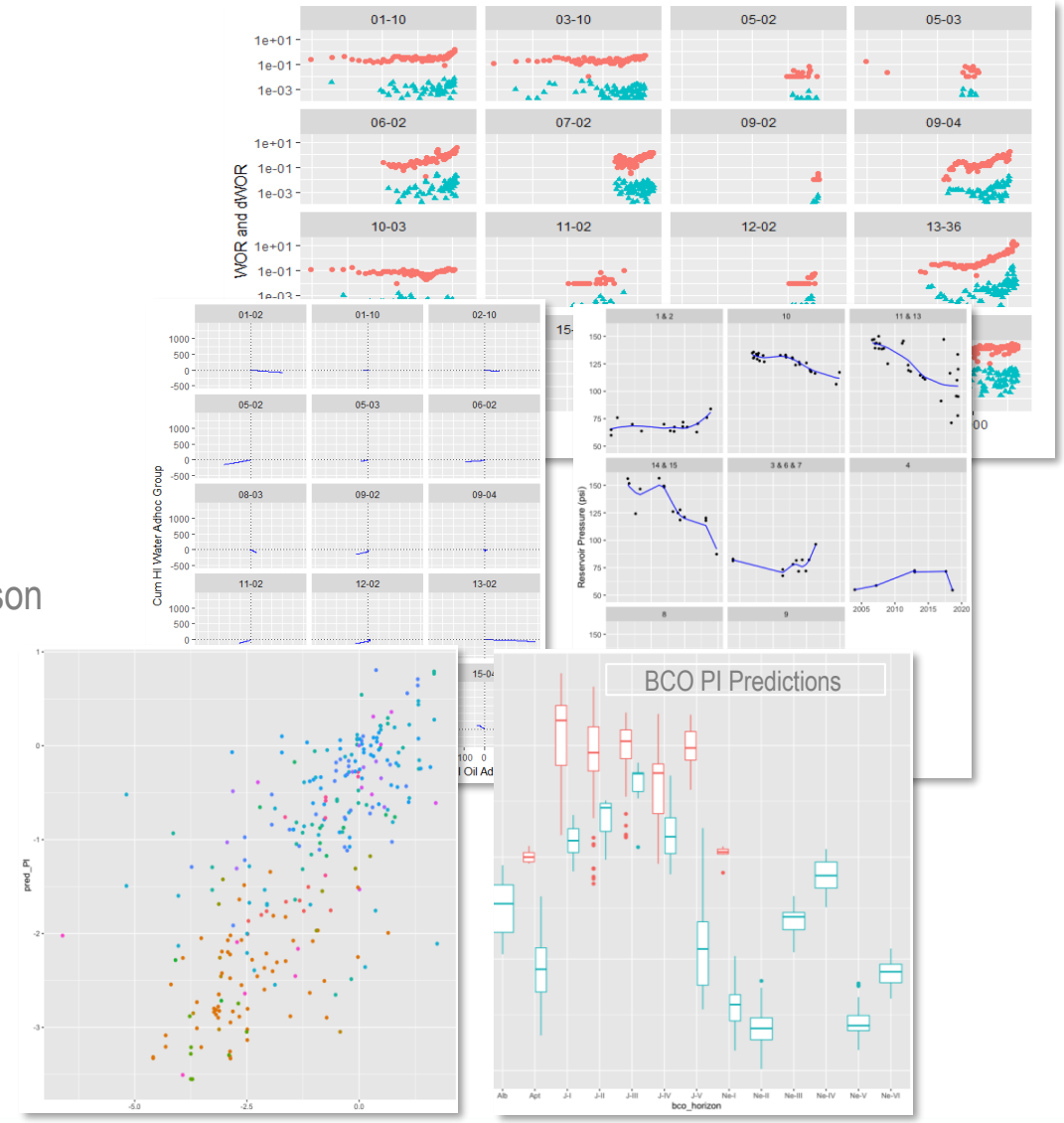
- AHP based ranking
- Gain based rankings
- Economics based Ranking

Screening | Water Control | Water Shut Off

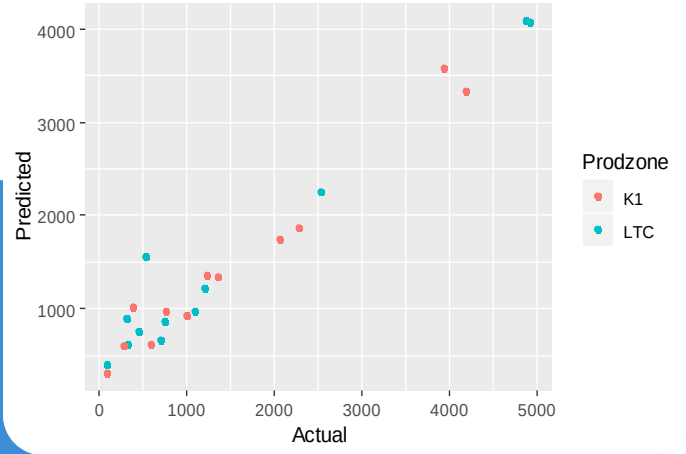


Diagnose | Analytics engines

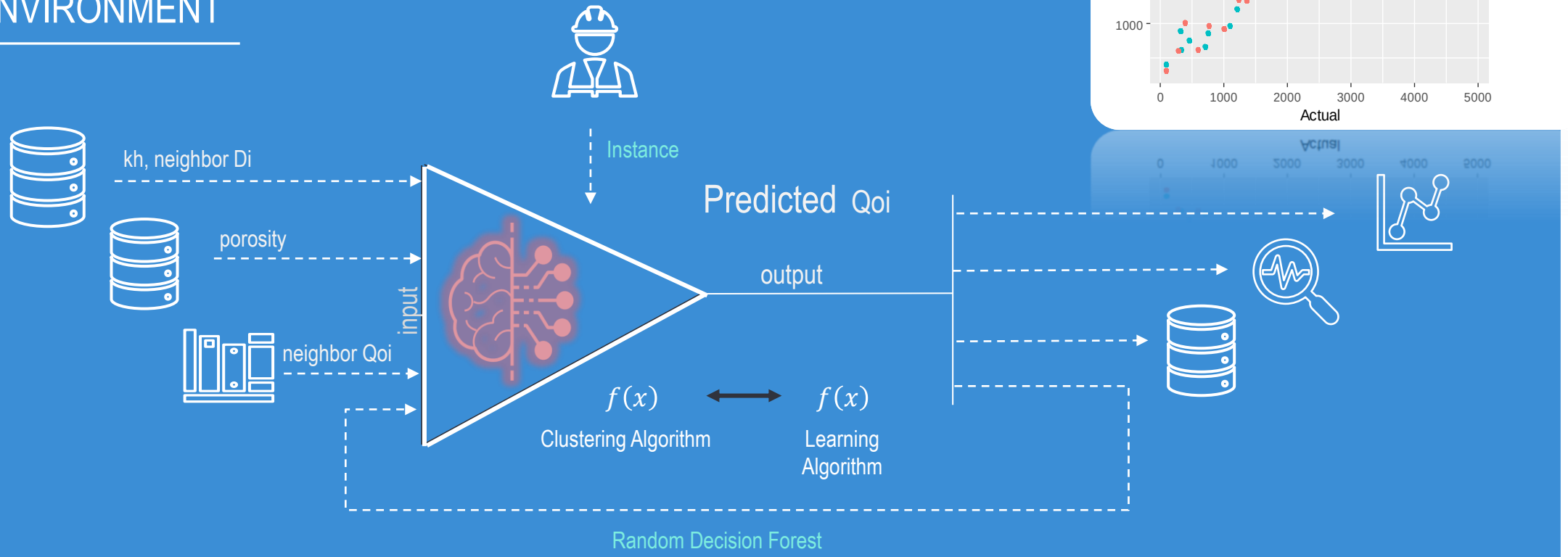




Analytics engines| BCO analysis with ML



ML ENVIRONMENT



Feed Learner Various Data

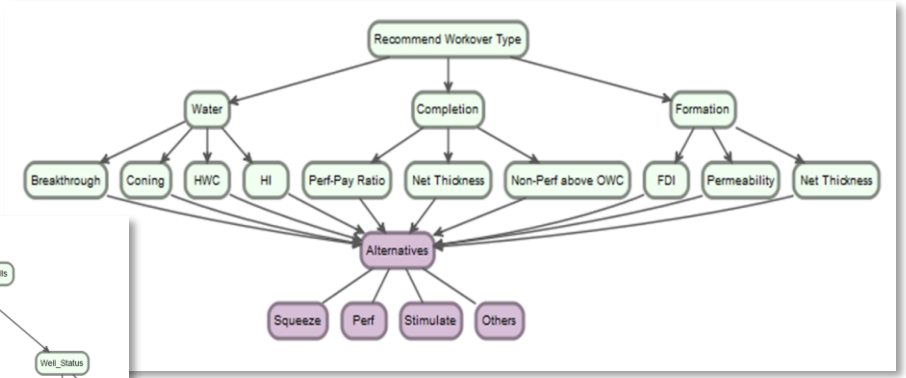
Align Type of Learning System

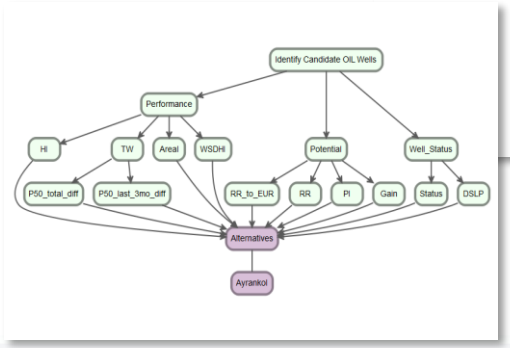
Result Presentation

Analytics Engines | AHP Ranking

Analytic Hierarchy Process (AHP) is used to analyze a multi-criteria decision analysis (MCDA) problem

- Reduce complex decisions to a series of pairwise comparison
- Synthesize both quantitative and qualitative criteria in objective manner
- Provide the capability of consistency checking
- Structure engineering decision making process into hierarchical decision trees





WPO | Final candidates ranking

positive NPV negative NPV

Rank	Well	WO Type	Inc Prod (STB)	($)		
1	HOGL332	Squeeze	8207	160752	14	60
2	13-36	Squeeze	6941	131610	12	60
3	PVE2_0...	Perf	5699	111279	13	60
4	HOGL2_...	Perf	5175	95782	16	60
5	16-04	Squeeze	3540	31347	33	60
6	PVEC2_...	Squeeze	3457	27218	38	60
7	PVED_0...	Perf	2589	23431	34	60
8	HOGL2_...	Squeeze	2805	13816	35	60
9	2362:B	Squeeze	2499	6232	41	60
10	HOGL732	Squeeze	2518	3100	55	60
11	PVEA_0...	Squeeze	1118	-38118	None	60

positive NPV negative NPV

Workover implementation | Well 116

Screening

Recommendation:
Horizon change

Implementation

Field implementation

Status before WO

- Rate: 1 m3/d
- **Water cut 97.5%**
- Flowing horizons: Apt, Ne-I
- BHP 67 bar (forecast)
- Pressure drawdown 14 bar

Calculations before WO

- $^{H_{perf}}/_{H_{sand}} = 0.8$
- Well PI: 0.04 m3/d/bar
- Oil cumulative: 10 736 m3
- **Remaining oil: 472 m3**

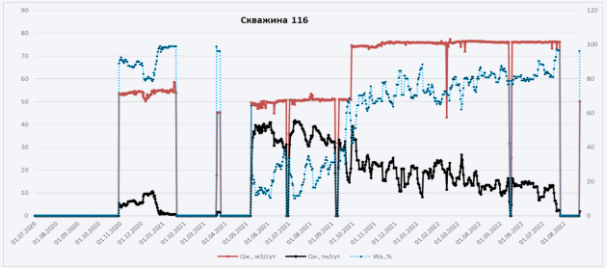
WPO conclusion

Chan plot:

- Water breakthrough probability: 99%
- Remaining oil: 4.2%

Proposed horizons to change:

- Alb: oil rate increment - 13 m3/d
- Ne-V-A: oil rate increment - 6 m3/d



WCT reduced
98% → 15%

Oil rate increased
1 m3/day → 37 m3/day

Workover implementation | Well P-15, 237, ОЦ-21

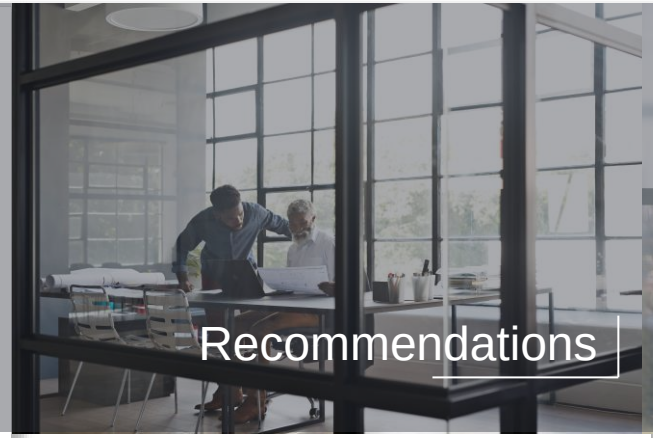
Well P-15
Field implementation:
- WCT reduced: 96% => 25%
- Oil rate increased: 1 => 40 m3/day

Well 237
Field implementation:
- WCT reduced: 98% => 15%
- Oil rate increased: 1 => 37 m3/day

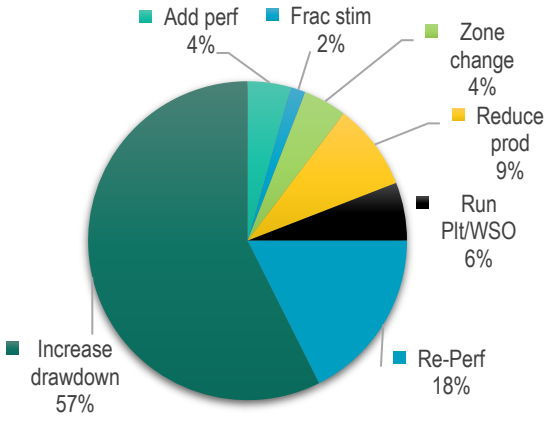
Well ОЦ-21
Field implementation:
- WCT reduced: 96% => 70%
- Oil rate increased: 1 => 20 m3/day

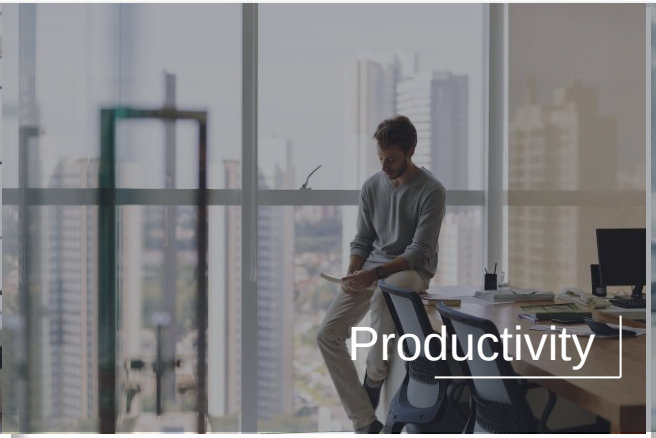
Benefits & Deliverables

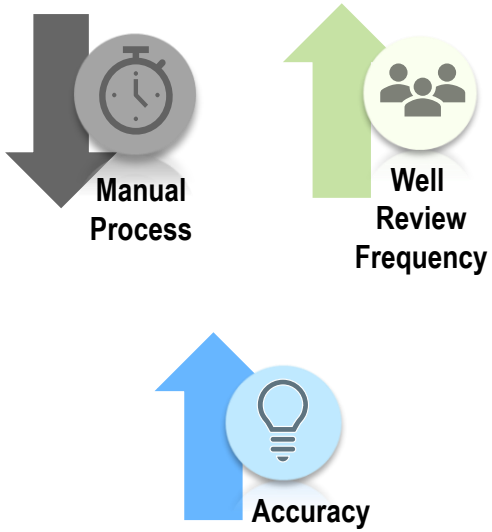
- Daily basis automatic screening
- Automatic problem well and cause of low productivity identification
- Quantitative analysis of best suitable type of workovers
- Ranking of most “desirable” candidates
- Standardized approach of candidate screening and workover type analysis
- Ongoing knowledge base update after implementation
- Automatic web reports



Recommendations after analysis
> 150 wells of Airankol Field







Gain = 1270 m3/d

* Potential profit from incremental production

from 1 week → to 30 mins

Thank you