



Role of Production Technologists and Engineers in the Petroleum Industry

By
Matthew Amao

Lecture Outline

- Stages in the Life of a Field or Reservoir
- Role of Production Engineers
- The Petroleum Production System
- Main Areas of Petroleum Technology
- Summary
- References

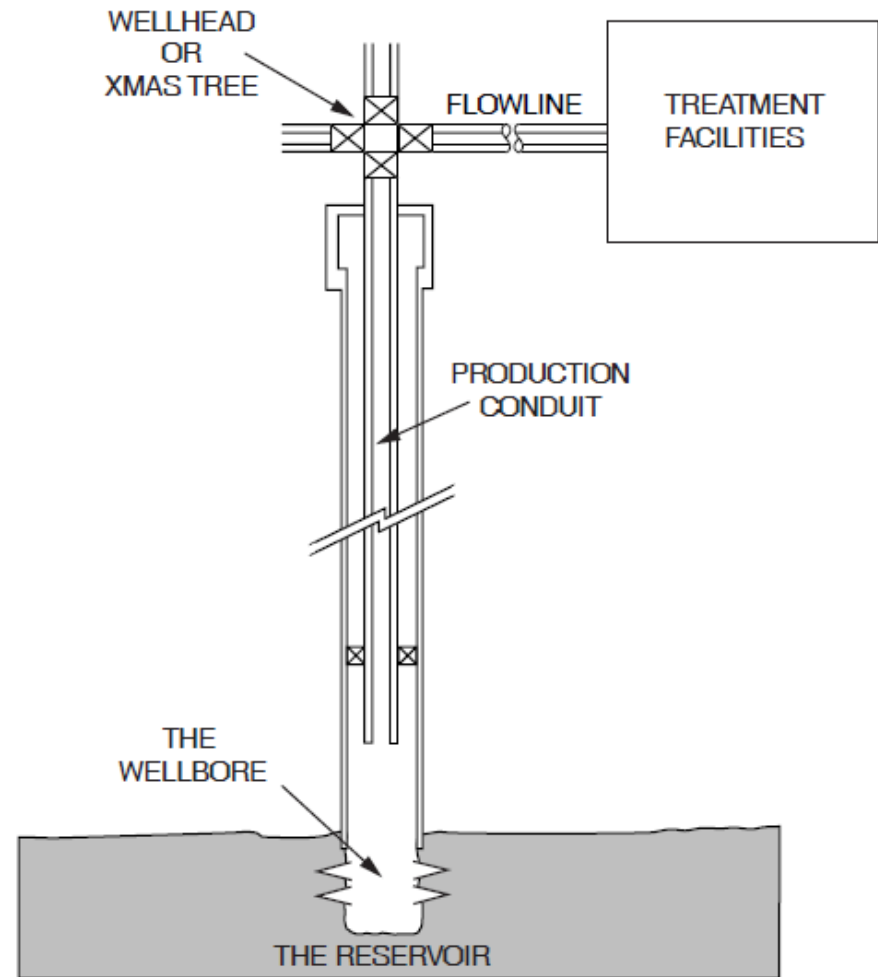
Life of a Reservoir

- Exploration
- Discovery
- Delineation
 - Drill wells to locate reservoir boundaries
- Development
 - Well spacing, geometry
 - Injectors and Producers
 - Artificial Lifts
 - Surface Processing Facilities
- Recovery and Exploitation
 - Infill Wells
 - Primary, Secondary, Tertiary Mechanisms
- Abandonment

The Production System

The Production System
Comprises of the following
Components;

- The Reservoir
- The Wellbore
- The Production Conduit
- Wellhead (Christmas Tree)
- Flow-lines
- Treatment Facilities



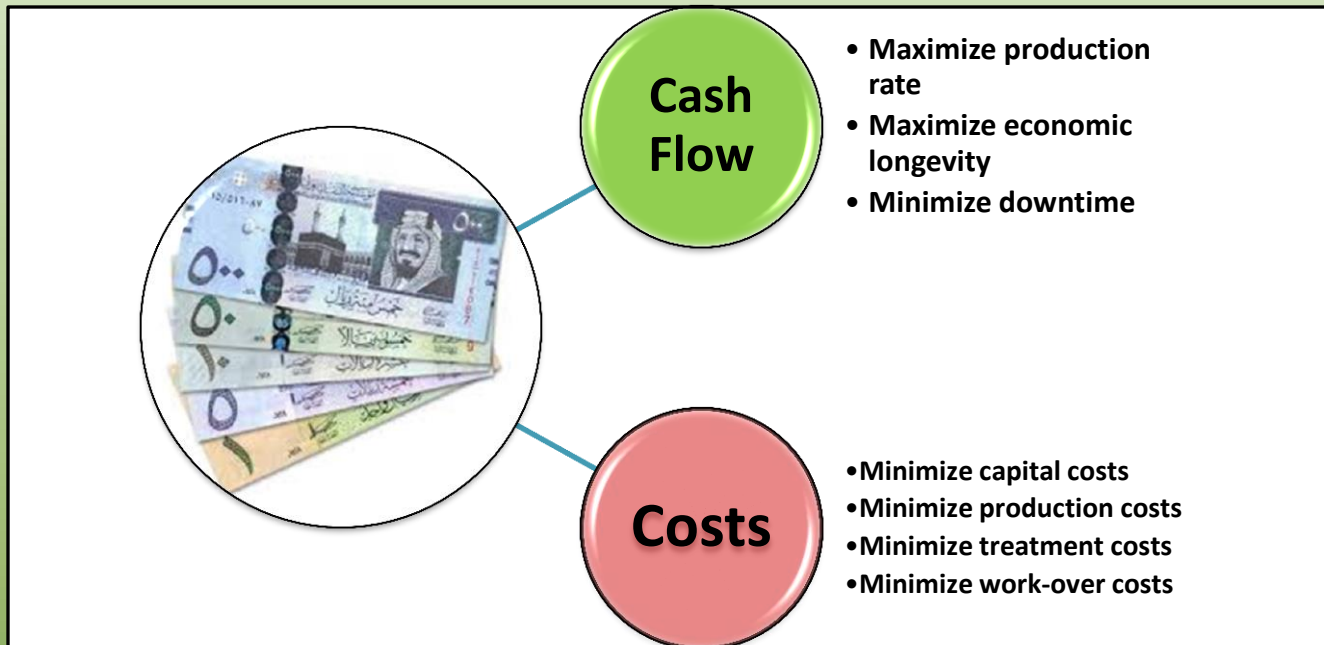
Role of a Production Engineer

- The role of a production engineer is to continuously achieve optimal performance from the production system and facility. Therefore, he must fully understand the workings and dynamics of individual components of the production system. Thus, he can use his skills, training, engineering judgment and available technological innovations to ensure their **optimal operation** and **performance** throughout the life of the well or reservoir.
- Optimal Operational Performance Implies the following;
 - Mechanical and physical operational efficiency
 - Economic Efficiency
 - Environmental Efficiency
 - Safety Efficiency
 - Non-Hazardous to Health of Colleagues and other Employees

Role of Production Engineers

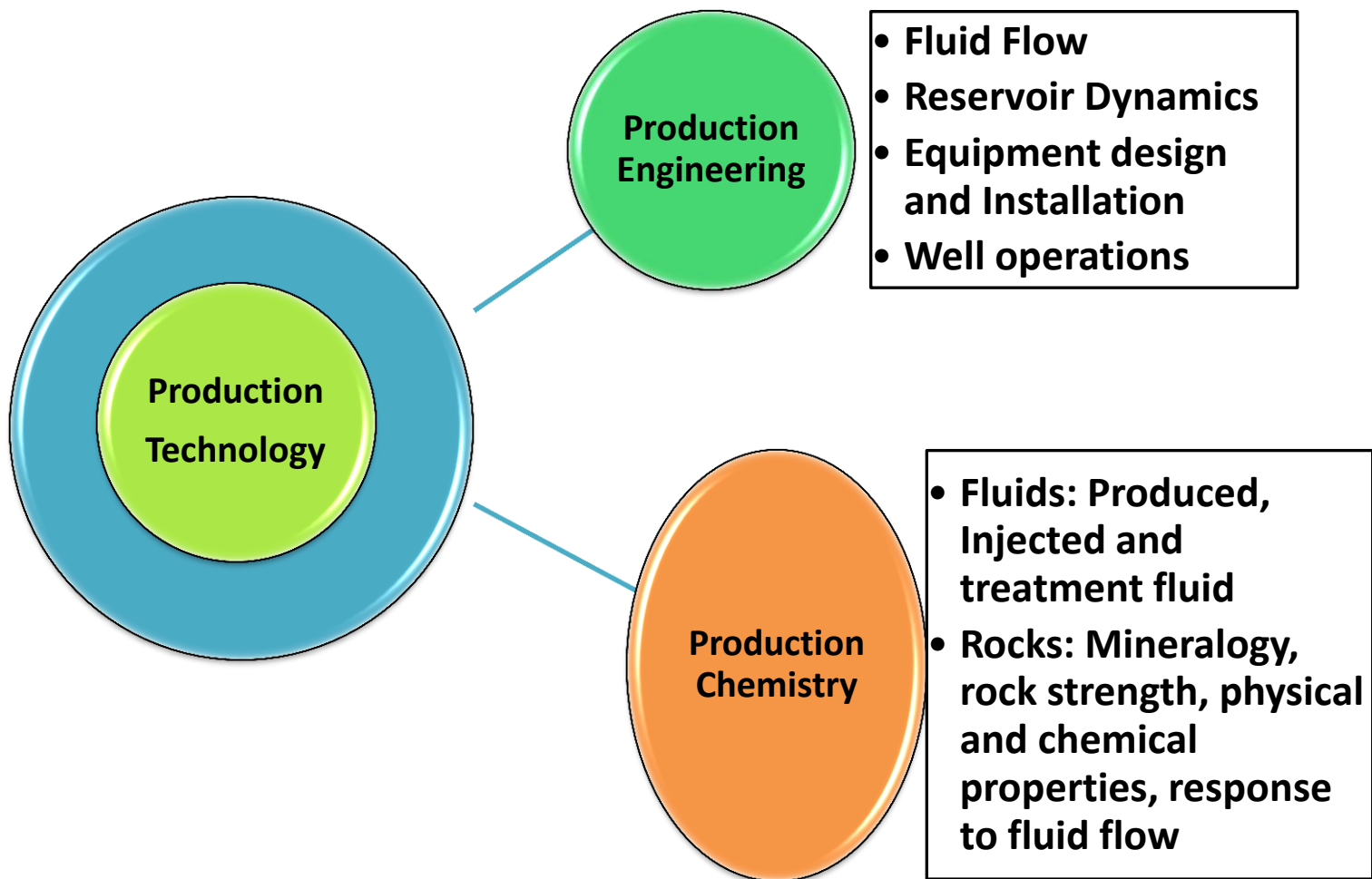
- Prepare near term production plans
- Prepare well completions programs
- Coordinate production logging activities
- Coordinate well testing jobs
- Design stimulation program
- Design surface production facilities
- Design Artificial Lift Equipment
- Acquire and monitor production data
- Optimize production
- Address Environmental Concerns e.g. water disposal
- Arrange for well servicing
- Arrange for work-over jobs
- Address pressure maintenance

Importance of Production Technology to Company Operations

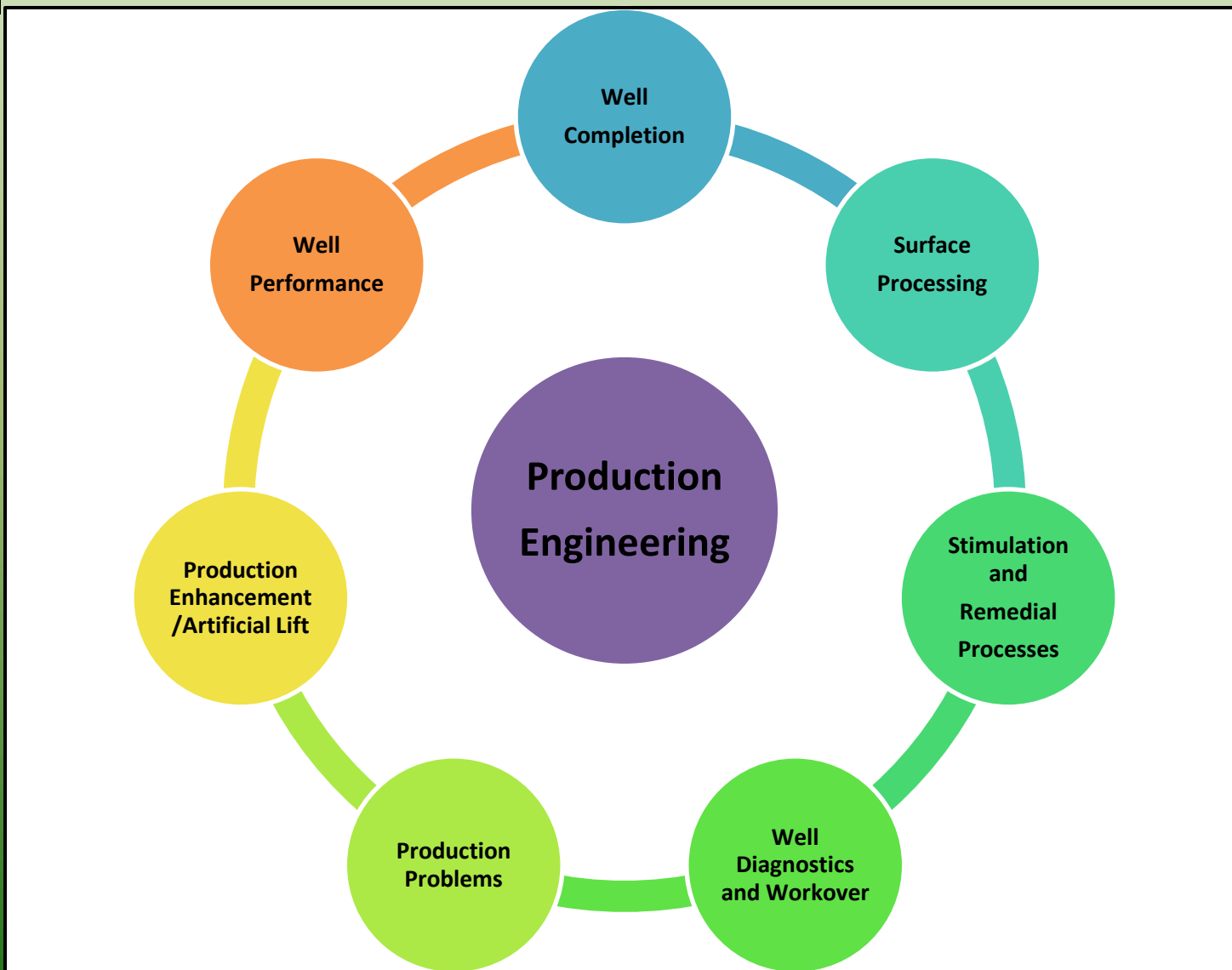


- Production Technology the mains interface with the produce of oil and gas companies. Hence it is the main money maker for the industry, that is, the source of cash flow. One can say that the production engineers are mostly responsible for a company's income and cash flow.
- A company's profitability can be achieved in two main ways;
 - Increase Cash flow
 - Minimize Cost

Production Technology



Key Subject Areas in Production Engineering

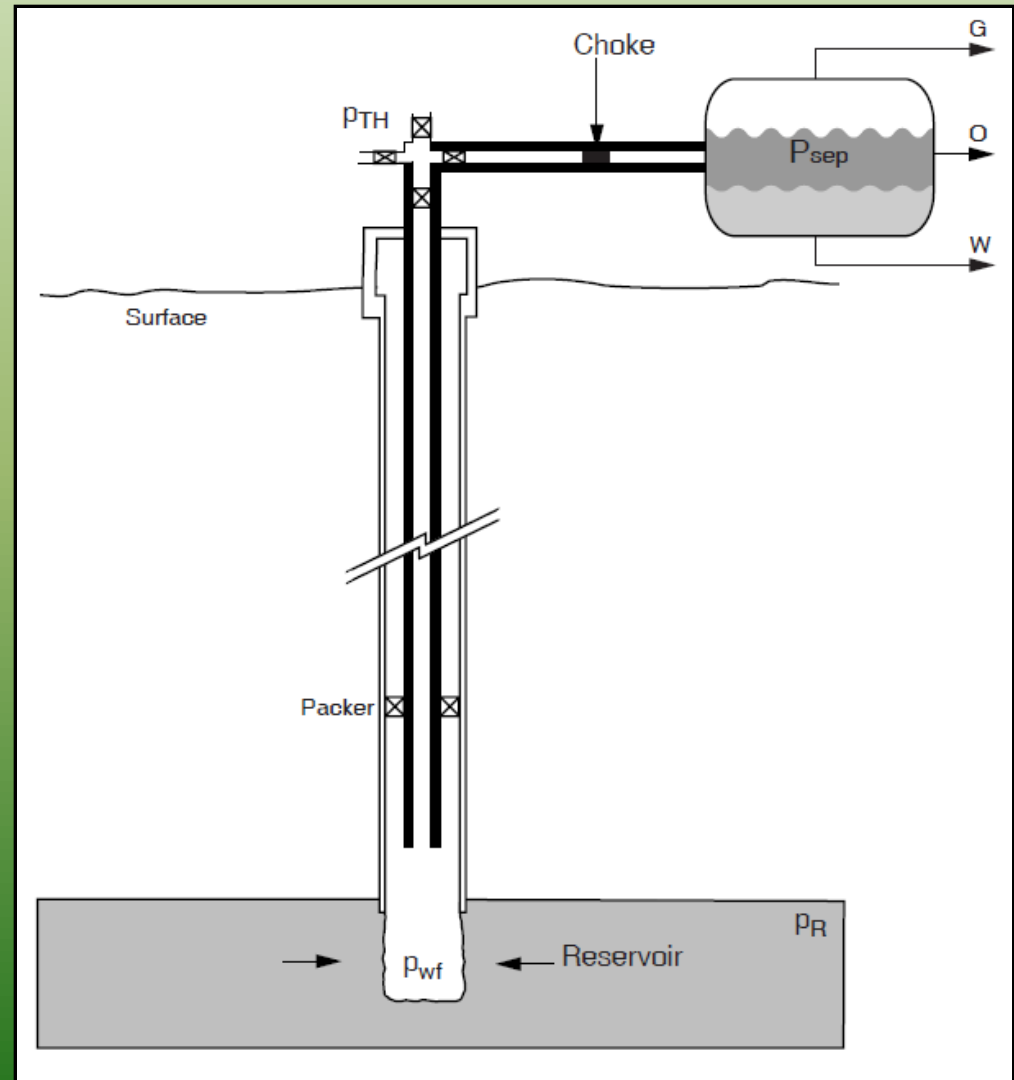


Well Productivity

The productivity of the well depends on an efficient use of the compressional energy available in the reservoir and reservoir fluids. The design of the production system must efficiently utilize this energy.

Pressure loss in the system which leads to dissipation of reservoir energy occurs at;

- The Reservoir
- The wellbore
- The Tubing String
- The Choke
- The Flow line
- The Separator

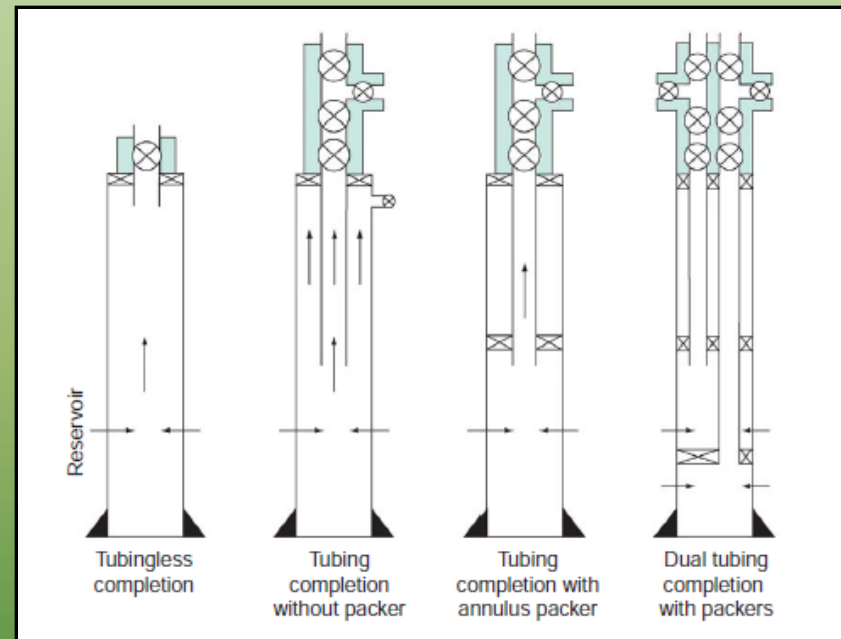


Well Completion

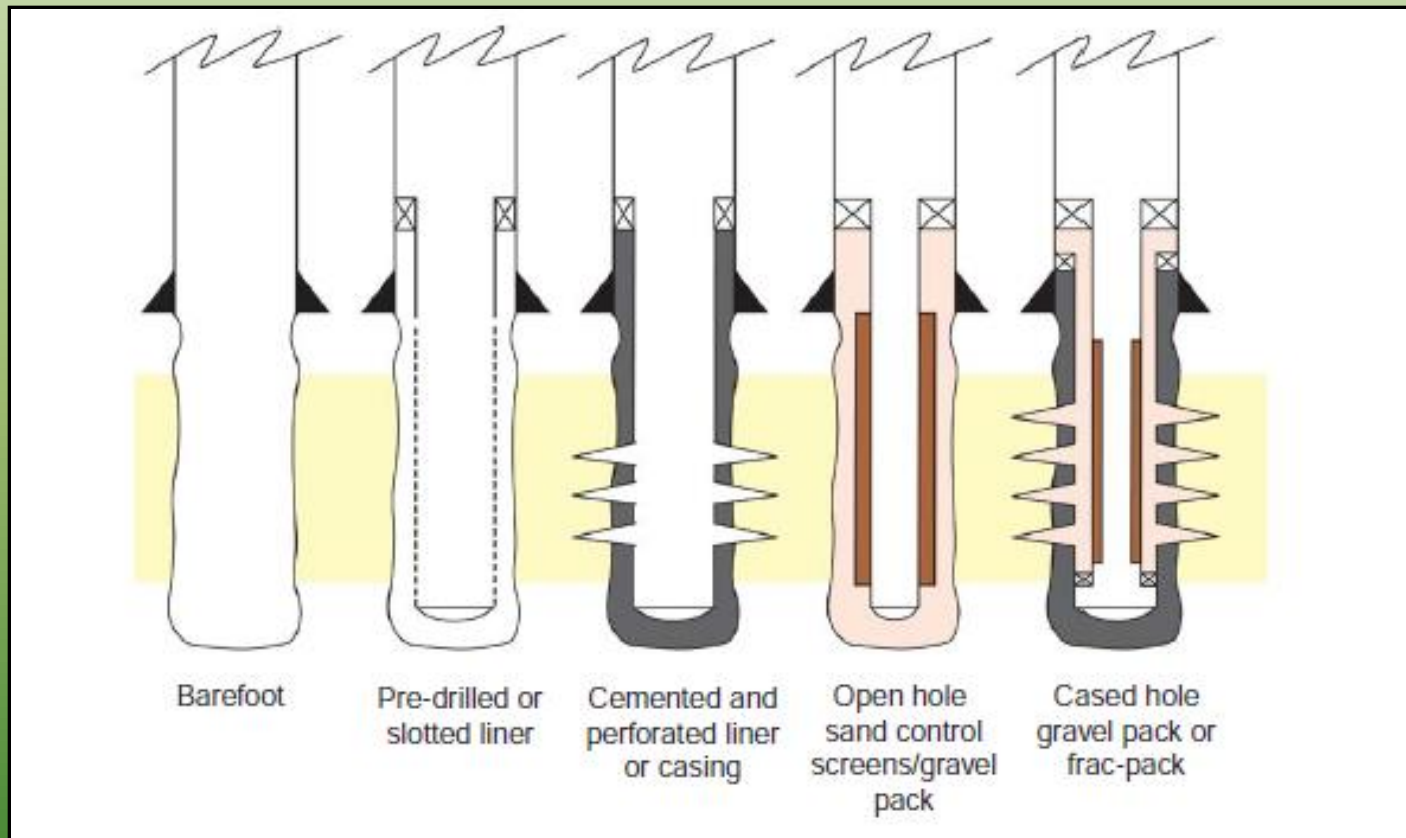
Completions are the interface between the reservoir and surface production. It consists of tubing/casing and other specialized devices.

Completion consists of;

- Determination and selection of the fluid that would be used to fill the wellbore during the completion process.
- Mode of entrance of the fluid from the reservoir into the wellbore, perforations, gun sizes, sand control etc.
- Design of tubing string to include other flow control devices, to ensure safe flow and minimal loss of pressure and possible re-entry for well services.



Well Completion Types



Well Stimulation

Well stimulation is an intervention process carried out around the wellbore to enhance the productivity of the well. Well stimulation can serve several purposes, depending on the well condition and situation.

Well stimulation is intended to;

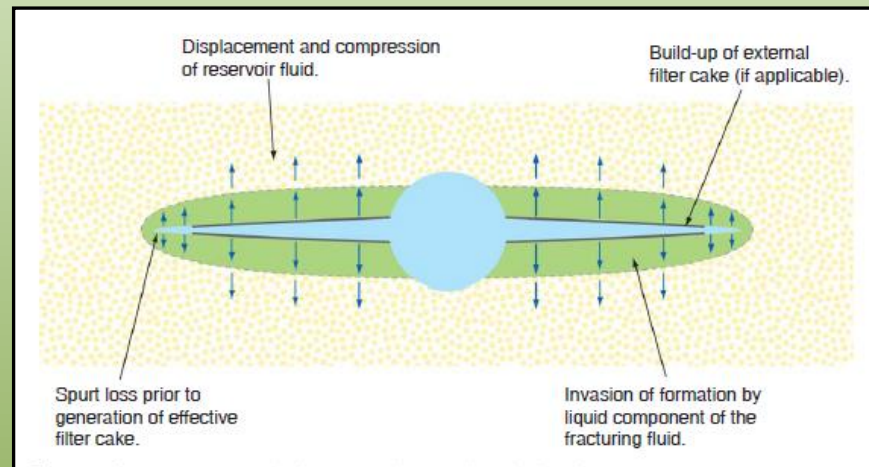
Remove damage around the wellbore

Improve interconnection between the pore space

Provide a long conductive channel into the reservoir in the case of hydraulic stimulation.

Examples of Stimulation Techniques are;

- Propped Hydraulic Fracture (Fracking)
- Acid Fracturing
- Matrix Acidization
- Frac Packing



Cured Resin Proppant

Associated Production Problems

Over the life of the well and reservoir, the system do undergo changes. These changes could be fluid related, rock related of even well related.

Changes could be due to the following reasons.

- Physico-chemical Changes
- Incompatibility of injected fluid and reservoir fluids
- Formation mechanical breakdown
- Fines migration
- Corrosion of tubulars and completion hardware
- Scale formation, foams, heavy metal deposits etc

Remedial and Workover Techniques

Remedial and work-over involves identifying and solving all well related problems. In solving a well problem, the cause of the problem must first be identified, this will enhance a right and appropriate solution.

The following are typical steps involved when carrying out a remedial action on a well.

- Identification of the problem and their source
- Plan the required Corrective action.
- Do some laboratory analysis and investigation to ensure validity of proposed corrective action or intervention.
- Identify required resources, skills and supervision
- During the execution, ensure strict compliance to safety and operational procedures to prevent any collateral damage to the well.

Artificial Lift

Due to decline in reservoir pressure or to achieve economic rates, it may be necessary to implement artificial lift systems in a well.

Artificial lifts systems assists the lift process in two main ways;

- Reduction of the flowing pressure gradient in the tubing, e.g. by reducing the hydrostatic head by injecting gas into the well stream. This is the main concept on which Gas Lift Systems are based.
- Providing additional power using a pump, the pump provides additional energy which supplement the energy losses in the tubing. This is the basis for pumping systems.

Surface Processing

These are all the processes carried out on the well stream once it gets to the surface to get it ready for the sales line. Also, it includes all necessary process and equipment to ensure right and environmental handling and disposal of fluids not meant for sales.

These processes include;

- Separation of oil, gas and water into distinct units from the production stream coming from the wellbore and reservoir.
- Monitor the properties of the products (oil and gas), to ensure they satisfy sales standard and contract agreement.
- Ensure right disposal of process and waste fluid, e.g. re-injection of produced water or gas.
- Pipe and channel products to either storage or pipelines. This may require the use of pumps, compressors and their sizing.

Summary

- Production engineering is a very important discipline in petroleum engineering.
- Production technology roles are broad and unique and they directly impact the operations and profitability of an Oil and Gas Company.

References

- Production Technology Course Notes, Herriot Watt University, Edinburgh, Scotland.
- Jonathan Bellarby, “Well Completion Design”, Development in Petroleum Science, Elsevier.



Role of Production Technologists and Engineers in the Petroleum Industry

By

Matthew Amao