ASSET UTILISATION INVESTIGATION

IE3100R Systems Design Project 2014/15 | Department of Industrial & Systems Engineering

PROBLEM DEFINITION

Weatherford Asia Pacific is currently facing sub-optimal levels of assets utilization rates, which has affected the firm's profitability and competiveness in the industry.

IMPROVEMENT FRAMEWORK

DMAIC is a six-sigma data-driven improvement cycle used for improving, optimizing and stabilizing business processes and designs. In this project, the DMAIC framework is adopted, and steps to define, measure, analyze, improve and control are followed.
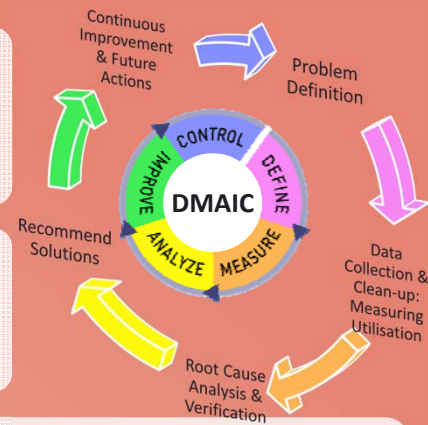
PROJECT OBJECTIVES

- **Identify** and **address** root cause factors contributing to sub-optimal levels of assets utilization rates
- **Analyze** and **introduce** solutions that will improve assets utilization rates
- **Recommend SOP** to enhance regional asset management, monitor performance and facilitate continual process improvement

MEASURING UTILISATION

$$Utilisation\ Rate = \frac{\sum Days\ on\ Rent}{\sum Total\ Fleet\ Days}$$
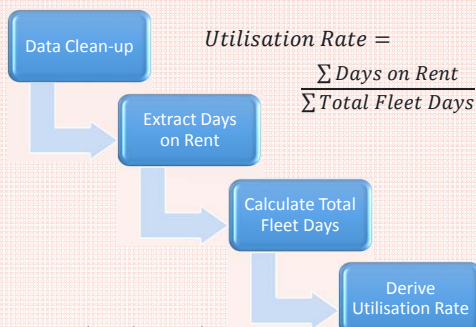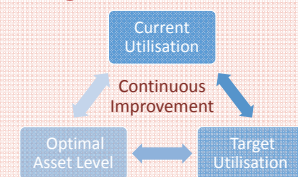
- Excel Template complete with VBA codes, user manual & SOPs

ROOT CAUSE ANALYSIS

- **Intuitive Purchasing Behavior** due to lack of purchase decision making tool
- **Absence of clear KPI** for asset utilization rates improvement
- **Conflicting utilization data reports** result in low quality information for asset management
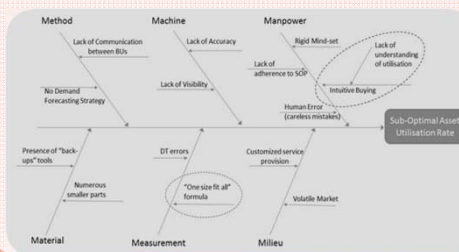
CONTROL

To ensure continuous improvement in asset management:
- Enhance cooperation and visibility of available inventory between business units
- Ensure the SOP and purchase decision model implemented in practice
- Use the target utilization rate for assets to quantify gap when driving up utilization rate

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RECOMMENDED SOLUTIONS

Benchmarking Utilisation

Objective: To provide a *target utilisation rate* that serves as a performance gauge

Assumptions
- Initial investment is paid by cash, there is no debt financing (i.e. interest payment)
- Annual rental revenue is constant
- Depreciation period is the same as the recovery period (i.e. 7 years in this case)
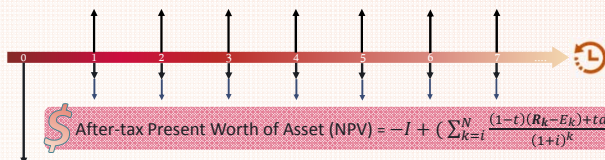
Variable	Explanation
	Initial investment = sum of all costs in order to get the asset into its ready state
U_t	Target utilization rate
R_k	Rental revenues generated in year k = Contract rental rate * U_t
E_k	Cash outflows during year k for deductible expenses
d_k	Depreciation amount in year k
t	Income tax rate which is assumed to remain constant during the study period
T_k	Income taxes cash flow for year k
N	Recovery Period
S	Salvage value (negative due to the cost of deposition)
i	After-tax MARR

Before-Tax Cash Flow for year k is revenues - expenses for that year: $BTCF_k = R_k - E_k$

Taxable Income for year k is the BTCF - depreciation for that year: $TI_k = BTCF_k - d_k = R_k - E_k - d_k$

Income Tax Cash Flow for year k is the (Tax Rate) x (Taxable Income): $T_k = -t(R_k - E_k - d_k)$

After-Tax Cash Flow for year k is: $ATCF_k = BTCF_k + T_k = (1-t)(R_k - E_k) + td_k$

$$After\text{-}tax\ Present\ Worth\ of\ Asset\ (NPV) = -I + \left(\sum_{k=i}^{N} \frac{(1-t)(R_k-E_k)+td_k}{(1+i)^k}\right) + \frac{(1-t)S}{(1+i)^N}$$
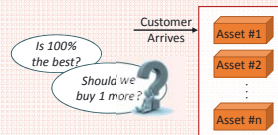
Target Utilization Rate (U_t)

The minimum utilisation rate that an asset needs to achieve each year during its recovery period to start generate profit fro Weatherford.
- Perform a Breakeven Analysis: Let After-Tax NPV =0 to obtain a value for R_k
- With R_k known, divide by annual average contract rate to obtain U_t

Optimal Fleet Size

Objective: To determine the *optimal asset level*, balancing the trade-off between lost revenue & holding cost, thus enabling a systematic approach in justifying a purchase decision
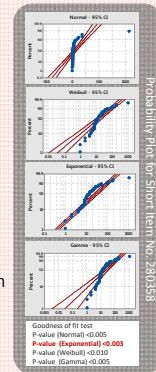
1. Model Conceptualisation
- Decision: Asset level n
- System Parameters:
  - i. Customer Arrival time
  - ii. Rental Period

2. Estimating System Parameters
i. Customer Arrival Distribution
   a. Consult expert to obtain opinion

ii. Rental Period:
   a. Use Excel template with customized Macro functions to extract data from DT records.
   b. Run data through Minitab to obtain distribution (see figure on right)

Goodness of fit test
P-value (Normal) <0.005
P-value (Exponential) <0.003
P-value (Weibull) <0.010
P-value (Gamma) <0.005

3. Run the simulation on Excel template
- Simulate order arrivals and service times for desired time frame
- Input relevant data and run simulation for 100 times. Calculate average no. of "days on rent"
- Generate results and plot After-Tax NPV against no. of assets

Simulation Example & Results

Asset #280358
Current no. of assets: 5 units
Simulate: +5 units

Operating Year	2015	2016	2017	2018	2019	2020	2021
Capital investment	68,100.00						
Annual Income		215,556	179,401	170,936	203,257	177,091	199,901
Operating costs		16,000	16,000	16,000	16,000	16,000	16,000
After-Tax Cash Flow		167,285	137,277	130,251	157,077	135,359	154,292

Conclusion:
Since NPV is maximum at 6, optimal asset level is 6. Thus it is alright to purchase 1 more unit of asset #280358

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