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Application of Models in Inventory Management in Oil and Gas Companies: A Case Study of Corporation in Port Harcourt

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Abstract:
This study applied models in inventory management in oil and gas companies using the warehouse in an Oil and Gas Company as a case study for data collection. The study identified the materials / parts managed as inventory, determined and applied inventory models used in the management of stocked items / raw materials and minimized inventory investment to maximize profits. The Technique for Order of Preference by Similarities to ideal Solution (TOPSIS), Pareto analysis and Analytic Hierarchy Process (AHP) models in inventory management were applied. The AHP model top priority with Pressure gauge items, followed by Control Systems and the least was completion. Result obtained using TOPSIS and Pareto analysis appeared to be similar, which placed the control systems as the most valuable with the highest usage rate, followed by pressure gauge. Hence, the top two priority items for inventory management of oil and gas companies is pressure gauge items and control systems. Based on the findings, the TOPSIS model appeared as the optimum and the most technically viable model for inventory management in the oil and gas industry.

Keywords: *Models, Inventory management, The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Analytical Hierarchy Process (AHP), Pareto Analysis model*

1. Introduction

The significance of inventory management, the requirement for the coordination of inventory choices and management strategies has for quite some time been obvious. Sharma (2003) depicted inventory as any sort of asset having monetary worth and is kept up with to satisfy the present and future necessities of an association. Sadly, overseeing inventory in a perplexing production network is regularly difficult and may fundamentally affect the client support level and production network framework (Serhii, 2015). Managers often need to resolve two significant issues when dealing with inventory management: -

- How should inventory be overseen to limit stock out issue and hold down inventory costs?
- When should arrangement be made for inventory?

Past works on inventory management have for the most part been centered on working of numerical models to improve inventory expenses and administration levels. This frequently incorporates the quantitative demonstrating of different boundaries utilized in inventory strategy like the monetary request amount, reorder point and wellbeing stocks. Unfortunately, the vast majority of these philosophies are excessively complicated, conceptual or distorted, consequently most administrators face troubles in comprehension and applying them in their work. Also, these models do not consider the subjective or theoretical components (like oldness, type and nature of providers) in the dynamic course of inventory management (Wai, 2010).

Generally speaking, there is no standard arrangement in inventory management. The conditions at each organization or firm are novel and incorporate a wide range of provisions and restrictions. Components of inventory management models are that the subsequent ideal arrangements can be carried out in a quick changing circumstance where, for instance, the conditions are changing every day. There is a requirement for new and successful techniques for displaying systems related with inventory management, despite vulnerability. Inventory management in Oil and Gas industry is large issue as it verges on specialized, non-specialized danger and non-useful time. At the point when the right extras/hardware for activities are not accessible it impacts pay, security and notoriety of the organization to follow through on guarantee. This has unfavorable impact on the exhibition and spirit of specialist and moreover their professional stability. There is likewise an issue of over loading as it will prompt cash being kept down by the supplied things.

This article speaks about application of various models in inventory management in oil and gas companies: utilizing the fruitions and well mediation stockroom as a contextual analysis.

2. Materials and Methods

2.1. Material Stock Inventory

Seven (7) broad spare parts were selected from material stock inventory list from the completions and well intervention warehouse of an Oil and Gas Company situated in Nigeria. Namely: Control Systems; Pressure Gauge; Packings/Rings/Screws; Wireline; Completion; Gasket/Flange/Guard and others.

2.2. Inventory Models Description

This article is centered on applying three (3) different inventory models on selected spare parts in the completions and well intervention warehouse of Oil and Gas Company. The inventory models are; The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) model, Analytical Hierarchy Process (AHP) model and Pareto Analysis model. The intent is to understand what model is best fit for inventory management.

2.3. AHP Model

AHP technique depends on three standards: first, design of the model; second, similar judgment of the other options and the rules; third, amalgamation of the needs. For the initial step, a complicated choice issue is organized as a chain of importance. AHP at first separates a complex Multiple Criteria Decision Making (MCDM) issue into an order of interrelated choice components (measures, choice other options). With the AHP, the goals, measures and options are organized in a progressive design like a family. A progressive system will have three levels: general objectives of the issue on top, numerous standards that characterize options in the center, and options at the base.

The AHP changes these assessments over to mathematical qualities that can be handled. A mathematical weight or need is inferred for every elective component of the chain of importance, permitting different and frequently incommensurable elective components to be contrasted with each other in a reasonable and predictable manner. In the last advance of the interaction, mathematical needs are determined for every one of the choice and options. These numbers address the options' overall capacity to accomplish the choice objective, so they permit a clear thought of the different approaches.

Every one of these decisions is then relegated a whole number on a scale.

2.3.1. Pairwise Comparison Matrix

Given a bunch of 'A' options: A1, A2, A3... An and a bunch of C models C1, C2, C3... Cn, the information of a choice framework will be given as: a11= (A1, A1); a12 = (A1, A2) ... a1n = (A1, An); a21 = (A2, A1); a22 = (A2, A2) ... a2n = (A2, An).

The pairwise examination table is numerically communicated as square lattice n x n, where n is the quantity of options or measures. The components of the framework are the assessed judgment loads, the overall significance among options or measures as clarified. For instance, the pair insightful examination grid A, where the component aij of the network is the general significance of the ith factor concerning the jth factor and reciprocals are appointed naturally as

$$A = \begin{bmatrix} 1 & a_{12} \cdots & a_{1n} \\ 1/a_{12} & 1 & a_{2n} \\ \vdots & \ddots & \vdots \\ 1/a_{1n} & \cdots & 1 \end{bmatrix} \quad \text{(Equation 1.0)}$$

For instance, consider the accompanying A1, A2, A3:

(1) Contrast A1 with A2
– Which is more significant?
Say A1
– By what amount? Say modestly → 3

(2) Contrast A1 with A3
– Which is more significant?
Say A1
– By what amount? Say emphatically significant → 5

(3) Contrast A2 with A3
– Which is more significant?
Say A2
– By what amount? Say Equally → 1

This arrangement of correlation gives the accompanying grid

	A1	A2	A3
A1	1	3	5
A2	1/3	1	3
A3	1/5	1/3	1

Table 1: Pair wise Comparison Matrix

2.3.2. Calculating The Weights and Determine the Consistency for Each Level

Weights are determined from the pair wise correlation lattices. The initial step summarizes the upsides of each line in the examination network. The line aggregates are then added to give the total. The column aggregate is then isolated by the complete total. The load for each line is given by Equation. 1.

$$Weig\ \ t = \frac{row\ sum}{total\ sum} \qquad \text{(Equation 1)}$$

	A1	A2	A3	ROW SUM	WEIGHT
A1	1	3	5	9.000	0.6054
A2	1/3	1	3	4.333	0.2914
A3	1/5	1/3	1	1.533	0.1031
			TOTAL	**14.866**	

Table 2: Weight of Pairwise Comparison Matrix

This progression is to track down the overall needs of measures or choices suggested by these correlations. The overall needs are worked out utilizing the theory of eigenvector. The consistency check is done at each phase of the choice interaction. To assess the consistency of the results, three parts are required from the investigation to be specific; Consistency Record (CI), Arbitrary Consistency List or Random Consistency Index (RI) and Consistency Proportion (CR).

$$CI = \frac{\lambda_{max} - n}{n-1} \qquad \text{(Equation 2)}$$

Where, λmax is the most extreme eigenvalue and n is the size of the pairwise correlation grid (i.e, the quantity of models).

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Table 3: Random Consistency Index (RI)

The acquired CI worth is contrasted and the arbitrary file RI given in Table 3. The Table 4 had been determined as a normal of CI's of numerous thousand frameworks of a similar request whose sections were produced arbitrarily from the scale 1 to 9 with proportional impact. The recreation consequences of RI for lattices of size 1 to 10 had been created by Saaty (1980) and are given in Table 4. The proportion of CI and RI for a similar request grid is known as the consistency proportion CR. Along these lines the consistency proportion (CR) is acquired by utilizing:

$$CR = \frac{CI}{RI} \qquad \text{(Equation 3)}$$

Accordingly, the CR <= 0.1

As a rule, a consistency proportion of 10% (0.1) or less is normally satisfactory. In the event that irregularity of decisions inside the grid has happened, assessment cycle ought to be explored and enhanced. At the last advance of the computation, the general inclination lattice would be developed by increasing every one of the loads with the elements, that way the outcomes are added to get the composite score of each factor.

2.4. TOPSIS Model

There are significant terms deserving of note when dealing with TOPSIS Model:

- Alternatives – These are the choices which will be looked at and broke down.
- Criteria/Characteristics – These are factors on which the assessments and correlations will dependent on.
- Weights – These are scores or focuses allotted to every measure dependent on their overall significance to the examination. Every model is allocated sure scores on a size of 1-10 or 1-100 by the choice maker(s).
- Decision maker(s) – These are specialists or people who has been delegated to relegate scores to the choices as for the models.
- Decision lattice – This is a table that is created to empower the target determination of a choice from a scope of choice or choices.
- Normalization: Standardization looks to get practically identical scales, which permits quality examination.
- The vector standardization approach isolates the rating of each quality by its standard to work out the standardized worth of xij as characterized in Equation (4).

$rij\ = x_{ij} / \left(\Sigma x_{ij}^2\right)^{\frac{1}{2}}$for i = 1... m; j = 1, ..., n(Equation 4)

Given the above terms, the formal TOPSIS method is characterized as follows:

- Stage 1: Develop standardized choice grid. This progression changes different quality measurements into non-dimensional characteristics, which permits examinations across models.
- Stage 2: Develop the weighted standardized choice grid. Expect a bunch of loads for every measure wj for j = 1,... ,n. Increase every segment of the standardized choice grid by its related weight. A component of the new lattice is: vij = wj rij, for I = 1, 2,... , m; j = 1, 2,... , n (3)
- Stage 3: Decide the positive ideal (A*) and negative ideal (A–) arrangements. The A* and A–are characterized as far as the weighted standardized qualities:

Positive Ideal arrangement

$A^* = \{v_1^* \dots v_n^*\}$, (Equation 5)

where:

$v_j^* = \{ max\,(v_{ij})\ if\ j \in J\ ;\ \ min\,(v_{ij})\ if\ \ j \in J\}$ (Equation 6)

Negative ideal arrangement

$A^{'} = \{v_1^{'} \dots v_n^{'}\}$, (Equation 7)

where:

$v^{'} = \{ max\,(v_{ij})\ if\ j \in J\ ;\ \ min\,(v_{ij})\ if\ \ j \in J'\}$ (Equation 8)

where, J is a bunch of advantage ascribes (bigger the-better sort) and J' is a bunch of cost credits (more modest the-better sort).

- Stage 4: Compute the partition measures for every other option.

$S_i^* = \left[\Sigma\left(v_j^* - v_{ij}\right)^2\right]^{\frac{1}{2}}$ i = 1, ..., m (Equation 9)

Likewise, the separation of individual options from the negative ideal alternative is as in Equation (10):

$S_i^{'} = \left[\Sigma\left(v_j^{'} - v_{ij}\right)^2\right]^{\frac{1}{2}}$ i = 1, ..., m (Equation 10)

- *Step 5:* Estimate the relative closeness to the ideal solution or similarities to ideal solution Ci*

$C_i^* = S_i^{'} / \left(S_i^* + S_i^{'}\right)$, $0 < C_i^* < 1$ (Equation 11)

- *Step 6*: By contrasting Ci qualities, the positioning of not really settled. Pick an elective with greatest Ci* or rank. TOPSIS thinks about m number of choices to choose from and n elements to put together the determination with respect to and one should score every choice against the relating factors.

Expect xij score of choice I regarding factor j, a lattice X = (xij) m x n framework is shaped. J is the arrangement of positive ascribes (the more, the better) and J' is the arrangement of negative credits (the less, the better). Each factor can be scored with specific focuses on a size of 0-10 0r 0-100 by the specialists (Assari, Mahesh and Assari, 2012).

TOPSIS thinks about m number of choices to choose from and n elements to put together the determination with respect to and one should score every choice against the relating factors.

2.5. Pareto Examination

Pareto Examination is a basic dynamic method for surveying contending issues and estimating the effect of fixing them. This permits you to zero in on arrangements that will give the most advantage. Pareto Examination utilizes the Pareto Guideline – otherwise called the '80/20 Standard' – which was instituted by Italian financial specialist, Vilfredo Pareto, in his 1896 book, 'Cours d'économie politique.'

The Pareto Standard expresses that 80% of a venture's advantage comes from 20% of the work. Conversely, 80% of issues can be followed back to 20 percent of causes. Pareto Investigation recognizes the trouble spots or assignments that will have the greatest result.

The device has a few advantages, including:

- Identifying and focusing on issues and undertakings.
- Improving usefulness.
- Improving productivity

2.5.1. Pareto Investigation Steps

2.5.1.1. Distinguish and Rundown Issues

Work out a rundown of each of the issues that you need to determine. Where conceivable, assemble input from customers and colleagues. This could appear as client studies, formal grumblings, or helpdesk logs.

2.5.1.2. Distinguish the Underlying driver of Every Issue

Then, get to the main driver of every issue. Procedures, for example, the 5 Whys, Circumstances and logical results Examination, and Underlying driver Investigation can be embraced here.

2.5.1.3. Score Issues

Score every issue that has recorded by significance. The scoring strategy that you use will rely upon the kind of issue that will be determined.

2.5.1.4. Assemble Issues Together

Utilize the main driver examination to gather issues by normal reason.

2.5.1.5. Include Scores for Each Gathering

Include the scores for each gathering that has been recognized. The one with the top score ought to be the most elevated need,and the gathering with the least score the least need.

2.5.1.6. Make a Move

At long last, it's an ideal opportunity to make a move! The most elevated scoring issue will probably have the greatest resultonce fixed, so begin conceptualizing thoughts on the best way to settle this one first. The minimal scoring issues do not merit worrying about, especially in case they are expensive to fix. Utilize Pareto Examination to save assets for what is significant.

2.6. Data Sources

Essential and optional information for pertinent periods were gathered. This was finished with the assistance of people responsible for tasks and inventory management in the organization. Information was gathered directly from the distribution center through assortment of material stock / inventory that has every one of the extra parts the organization has been utilizing for more than five (5) years. Applicable data from distributed works were likewise utilized by the scientist for information examination.

As part of data collection and analysis, the workshop personnel were interviewed to understand how inventory is managed in the organization.

2.7. Technique for Data Analysis

Investigation was attached to every unbiased in order to arrive at dependable resolutions and accomplish the motivation behind the expectations. Ideal models were created utilizing TOPSIS, AHP and Pareto. All models were analyzed, and the best model was suggested.

3. Results and Discussion

3.1. Results

Pareto – Table 4 highlights scores for the different categories. On the table the important items are categorized first and the least items last, then a weighted score (10 – highest, 1 – lowest) is place on them.

S/N	Description	Weight
1	Control Systems	10
2	Pressure Gauge	9
3	Packings, Rings, Screws	8
4	Wireline	7
5	Completion	6
6	Gasket, Flange, Guard	5
7	Others	4

Table 4: Pareto Scores of the Categories

TOPSIS – Table 5 shows how weights are assigned to the criteria using rating scale. Here, how often an item is used and the unit rate are classified between 1 and 0, 1 means most often used and 0 means not important.

Option No	Criteria	Weight
1	Rate of Usage	0.7
2	Unit Value	0.8

Table 5: Criteria and Weight

Table 6 below highlights the score of the electives i concerning properties j. This is used to construct the normalized decision matrix. This step converts the various attribute dimensions into non dimensional attributes.

Alternatives	Usage rate	Unit value	Rating Scale
Control Systems	9	8	(1-10) 1 means very poor, 10 means very excellent
Pressure Gauge	8	9	
Packings/Rings/Screws	6	6	
Wireline	6	6	
Completion	5	5	
Gasket/Flange/Guard	5	6	
Others	6	6	

Table 6: Xij = Score of Option I with Respect to Criterion J

Table 7 highlights different alternatives with respect to usage rate and unit value. This will help to calculate the weighted normalized decision matrix.

Alternatives	Usage Rate	Unit Value
Control Systems	0.747409319	0.664363839
Pressure Gauge	0.664363839	0.747409319
Packings/Rings/Screws	0.707106781	0.707106781
Wireline	0.707106781	0.707106781
Completion	0.707106781	0.707106781
Gasket/Flange/Guard	0.6401844	0.76822128
Others	0.707106781	0.707106781

Table 7: The Normalized Decision Matrix $rij = x_{ij} / \left(\Sigma x_{ij}^2\right)^{\frac{1}{2}}$

Table 8 provides clarity on the calculation of separation measure. The separation distance of each alternative to an ideal solution measured against a negative-ideal solution.

Alternatives	Usage Rate	Unit Value
Control Systems	6.726683868	5.314910711
Pressure Gauge	5.314910711	6.726683868
Packings/Rings/Screws	4.242640687	4.242640687
Wireline	4.242640687	4.242640687
Completion	3.535533906	3.535533906
Gasket/Flange/Guard	3.200921998	4.609327678
Others	4.242640687	4.242640687

Table 8: The Weighted Normalized Decision matrix $v_{ij} = w_j r_{ij}$

Table 9 calculates the relative closeness to the ideal solution. Where 0 is lesser or equal to $\boldsymbol{C_i^*}$ greater or equal to 1 that is, an alternative i is closer to A* as $\boldsymbol{C_i^*}$ approaches to 1.

	Usage rate	Unit value
Si*	1.994169001	1.993103448
Si'	1.411773157	3.976710006
Si*+Si'	3.405942158	5.969813454
Si'/(Si*+Si')	0.414502975	0.666136394

Table 9: Computation and Results of the Relative Closeness to the Ideal Solution

$$C_i^* = S_i' / \left(S_i^* + S_i'\right)$$

Table 10 shows the choices load. It is about ranking the preference order. This helps to choose an alternative with maximum relative closeness.

Options	Topsis Priority
Control Systems	9.059617925
Pressure Gauge	9.311251344
Packings/Rings/Screws	6.483836213
Wireline	6.483836213
Completion	5.403196844
Gasket/Flange/Guard	6.069333238
Others	6.483836213

Table 10: TOPSIS Options Weights

AHP – Table 11 highlights alternatives in relations with unit values and usage rate. The items are categorized into frequency of usage with unit value tied to each item.

Alternatives	Unit Value	Usage rate
Control Systems	9	8
Pressure Gauge	8	9
Packings/Rings/Screws	6	6
Wireline	6	6
Completion	5	5
Gasket/Flange/Guard	5	6
Others	6	6

Table 11: Score of Alternative 'A' with respect to criterion 'C'.

Table 12 highlights the pairwise comparison matrix. This was used to compute for relative priorities of criteria.

Criteria	Unit Value	Usage Rate
Unit value	1	0.8
Usage rate	1.25	1

Table 12: Pair-wise Comparison Matrix

Table 13 highlights how the pairwise comparison matrix is normalized, the weight of each criterion was determined.

Criteria	Unit value	Usage rate
Unit value	0.444	0.444
Usage rate	0.556	0.556

Table 13: Normalized Pairwise Comparison Matrix

Table 14 shows criteria weight computation. This is basically averaging the components in each line.

Criteria	Unit value	Usage rate	Criteria Weight
Unit VALUE	0.444	0.444	0.444
Usage RATE	0.556	0.556	0.556

Table 14: Criteria Weight Computation

Table 15 highlights the understanding that the weights derived from the pairwise comparison matrix are consistent.

Criteria	Unit value	Usage rate
Unit value	0.444	0.4448
Usage rate	0.555	0.556

Table 15: Consistency Computation

Table 16 shows how the weighted sum was computed. The weighted sum is simply taking the sum of each value in the row.

Criteria	Unit value	Usage rate	Weighted Sum
Unit Value	0.444	0.4448	0.8888
Usage Rate	0.555	0.556	1.1111

Table 16: Weighted Sum Computation

Table 17 highlights the proportion of the weighted total worth and the model weight.

Weighted Sum Value	Criteria Weight	Ratio
0.8888	0.444	2.0018
1.1111	0.556	1.9984

Table 17: Ratio of Weighted Sum Value to Criteria Weights

Table 18 speaks to validation of the criteria weight. It provides clarity on the usage rate and the unit value.

Criteria	Weighted Sum Value	Criteria Weight
Unit Value	0.8888	0.444
Usage Rate	1.1111	0.556

Table 18: Validated Criteria Weight

Table 19 highlights the standardization of alternatives with respect to the criteria. This is simply obtaining numerical and comparable input data.

Alternatives	Unit Value	Usage rate
Control Systems	0.444	0.493172
Pressure Gauge	0.394716	0.556
Packings/Rings/Screws	0.296148	0.370852
Wireline	0.296148	0.370852
Completion	0.296148	0.370852
Gasket/Flange/Guard	0.246864	0.309136
Others	0.296148	0.370852

Table 19: Normalized Values for the Score of Alternative 'A' with Respect to Criteria 'C'

Table 20 highlights the standardized qualities in Table 19 with the relating measured weight of the segment.

Alternatives	Unit Value	Usage rate
Control Systems	1	0.887
Pressure Gauge	0.889	1
Packings/Rings/Screws	0.667	0.667
Wireline	0.667	0.667
Completion	0.556	0.556
Gasket/Flange/Guard	0.556	0.667
Others	0.667	0.667

Table 20: Model Synthesis

Table 21 shows the order at which the different alternatives are prioritized.

Alternatives	Overall Priority (AHP Score)
Control Systems	0.937172
Pressure Gauge	0.950716
Packings/Rings/Screws	0.667000
Wireline	0.667000
Completion	0.605284
Gasket/Flange/Guard	0.617716
Others	0.667000

Table 21: Overall Priorities for Inventory Management Using AHP Analysis

Figure 1 shows a graph of aggregated weight against the different items.

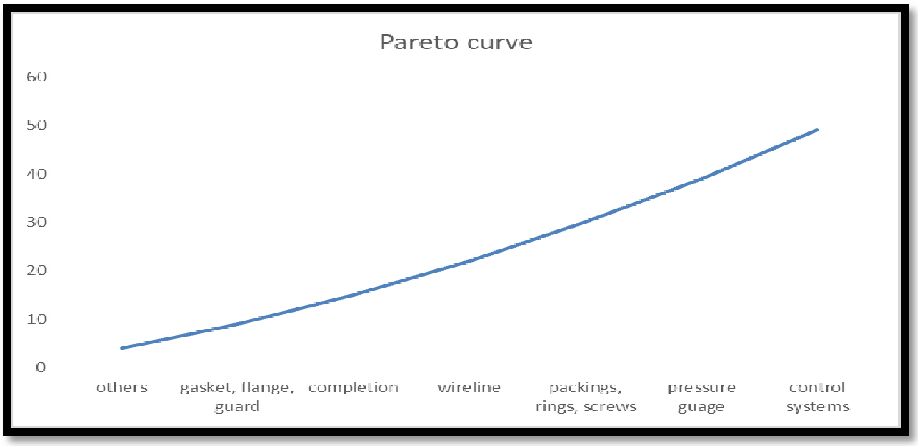

Figure 1: Pareto Curve for the Study

Figure 2 shows the bar chart representation of Figure 1 Control systems ranked top closely followed by Pressure gauges.

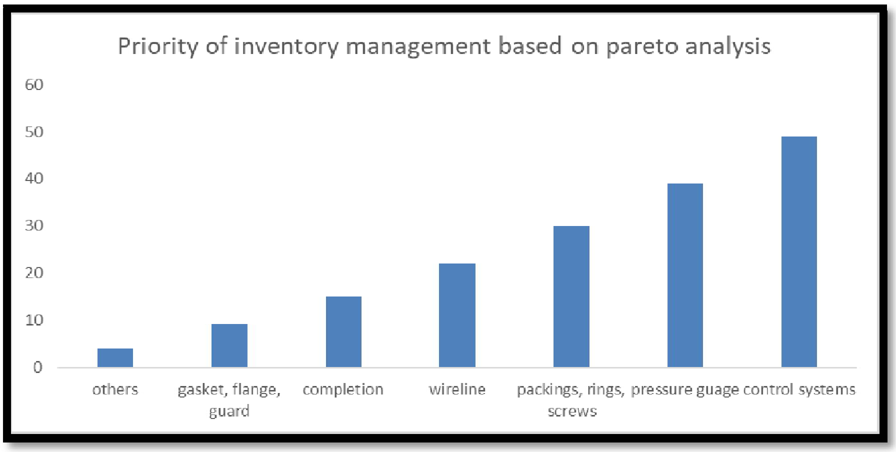

Figure 2: Priority of Inventory/Stock Management

Figure 3 show a graphical representation of the item choice. Pressure gauge ranked highest with Completion the least.

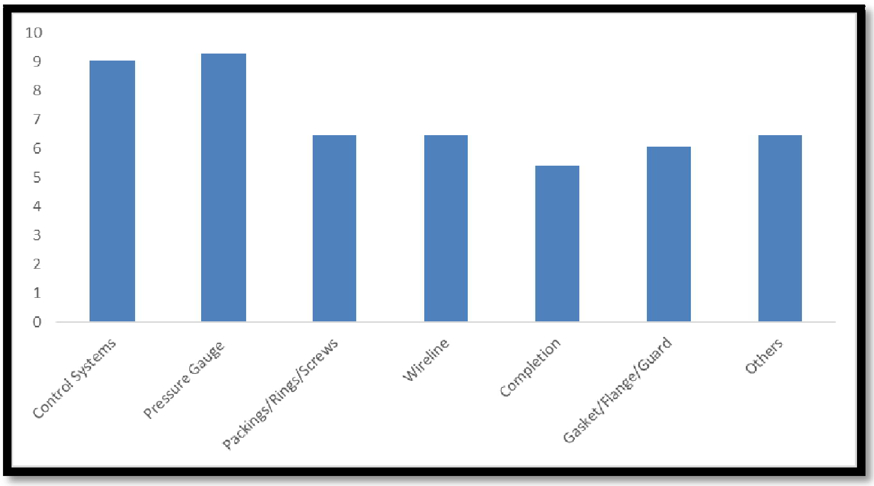

Figure 3: TOPSIS Prioritization for Inventory Management

Figure 4 is a graphical representation of the different alternative (items). Pressure gauges ranked tops in the inventory list.

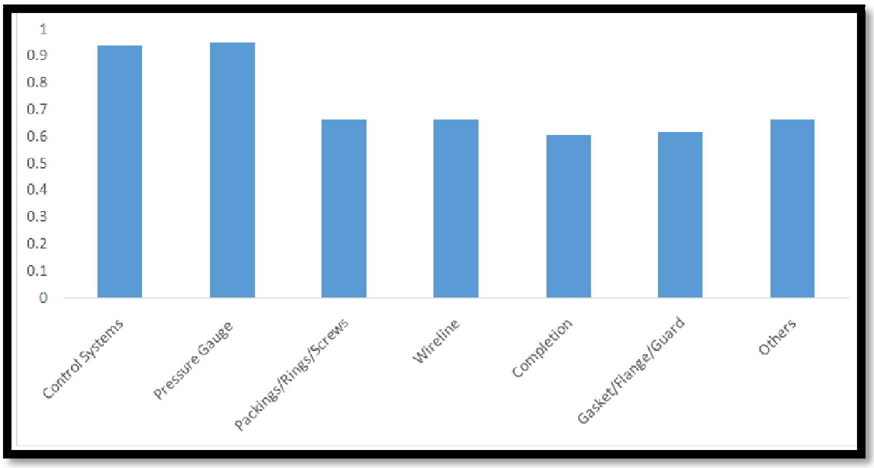

Figure 4: Plot of AHP Scores of the Alternatives

3.2. Discussion

In this Pareto investigation, the main things showed up at the first spot on the list as prior expressed. It is deserving of note that the request for the materials is as per the two components being thought of, which are the expense of the things and the utilization rate. From Table 4, it then, at that point, suggests that the control systems aggregately are more important and have the most noteworthy utilization rate, trailed by pressure measure, till 'other'. In accordance with this and following the Pareto 80/20 standard, the top classifications got higher weighting.

The plot in Figures 1 & 2 was made by taking aggregate upsides of the scores against every class.

Applying TOPSIS to this review; m = 7 other options and n = 2 wide properties/measures, which are completely introduced in Table 5. The weighting utilized for the TOPSIS examination was finished by a group of specialist'sdependents on how significant they feel that every basis depends on point of the investigation. The normal of the weighting for every basis is given as displayed in Table 5. xij is the score of electives i concerning property j as displayed in Table 6. j is set of advantage credits: control systems, pressure check, packings/rings/screws, wireline, finishing, gasket/flange/guard and others. Notwithstanding the scores/weightings, the analyst in addition scored the options against the rules dependent on the results of writing survey/auxiliary information relating to utilization pace of the things and the unit upsides of the things.

With Tables 6 and 7 set up, the TOPSIS investigation steps was applied.

The standardized choice grid rij is displayed in Table 7. The weighted standardized choice grid is created by duplicating every segment of the standardized choice lattice by its related weight.

Applying TOPSIS in the examination came about to:

- Stage 1: Normalizing the choice grid

This progression makes the evaluations dimensionless by isolating every segment of the choice lattice and amount of square of particular columns. This is displayed in Table 7. Every segment is partitioned to get rij which is the normalized choice lattice as displayed in Table 7.

- Stage 2: Foster weighted normalized choice framework by duplicating the rules weight (see Table 6) with each appraising in Table 9. The weighted normalized choice network is introduced in Table 8.
- Stage 3: Decide ideal other option and negative ideal other option

A bunch of most extreme qualities for every models is the ideal other option while a bunch of least qualities for every rules is the negative ideal other option

Ideal alternative A*: {6.726683868, 6.726683868, 4.242640687, 4.242640687, 3.535533906, 4.609327678, 4.242640687}
Negative ideal alternative A': {5.314910711, 5.314910711, 4.242640687, 4.242640687, 3.535533906, 3.200921998, 4.242640687}

- Step 4 (a): Determine separation S_i^* from ideal solution (A*).

$$S_i^* = \left[\Sigma\left(v_j^* - v_{ij}\right)^2\right]^{\frac{1}{2}} \text{ for each column of Table 8.}$$

$S_i^* = \left[\Sigma\left(v_j^* - v_{ij}\right)^2\right]^{\frac{1}{2}}$ = {1.994169001, 1.993103448}

- Step 4 (b): find separation from negative ideal solution (A') and $S_i' = \left[\Sigma\left(v_j' - v_{ij}\right)^2\right]^{\frac{1}{2}}$ for each column as shown in Equation 12:

$S_i' = \left[\Sigma\left(v_j' - v_{ij}\right)^2\right]^{\frac{1}{2}}$ = {1.411773157, 3.976710006} Equation 12

- Step 5: Calculate the relative closeness to the ideal solution $C_i^* = S_i' / \left(S_i^* + S_i'\right)$

The grid of the closeness to the ideal arrangement is given in Table 9.

The worth of the aggregate gives the need of the inventory management dependent on TOPSIS examination (see Figure 3). Table 10 shows the TOPSIS Choices loads.

From Figure 3, TOPSIS first concern for inventory management is pressure measure, trailed by control systems, with the least as Completions.

To initiate the AHP examination, pairwise correlation of the standards should be finished. To achieve this, questions are asked on how critical one basis is in contrast with the other. With this, the choices beneath were taken concerning the significance of one measure comparative with the other:

In the event that unit esteem (for example cost) = 5x; use rate = 4x

The ramifications of the assigned qualities. 5x infers that the rule is 5 multiple times (unequivocally) more huge than the rule it is being looked at against; 4x suggests that the measure is 4 multiple times more huge than the rule it is thought about against; 3x infers that the standard is 3 multiple times (tolerably) more huge than the model it is being analyzed against; 2x infers that the rule is twice times more critical than the rule it is analyzed against while x infers that the rule is of equivalent importance with the basis it is being thought about against.

From the pairwise examination, it then, at that point, implies that the unit esteem is the 1.25 occasions more significant than the utilization rate.

For the inventory management, the point is to focus on choices with higher unit esteem and higher use rate. Applying AHP in the examination, the pair-wise correlation network is built as displayed in Table 12. In Table 12, the line components have been separated by the section components.

The following stage was to standardize the pairwise network by partitioning the component of every section by the amount of the segment. The result of this progression is given in Table 13.

In normalizing the pairwise lattice, the model's weight was determined by averaging every one of the components in the line. That is, amount of the line components isolated by the quantity of standards. The result of this progression is given in Table 14.

To check if the determined qualities are right, the consistency was determined. To do this, the non-standardized (introductory) pair-wise examination grid was utilized. Each worth in the segment is duplicated with the measures esteem and the outcome is given in Table 15. Now, the weighted aggregate worth was determined by taking the amount of every component in the column. The outcome is displayed in Table 16.

The proportion of the weighted total worth and the model's weight was then taken. The result is displayed in Table 17.

λmax was determined by taking the normal of the proportion esteems. From Table 17, the normal of the proportions was processed by adding the proportion and separating the aggregate by the quantity of rules (2). The outcome gave λmax = 2.0001.

Then, at that point, the Consistency Proportion (C.R) was determined as a proportion of Consistency List (C.I) to Irregular File (R.I) (see Eqn. 3). The Arbitrary File Table is displayed in Table 3. From Table 3, the Arbitrary File an incentive for 7 other options (N=7) is given as 1.32. In this way, calculating the Consistency Proportion gave C.R = 7.578 x 10-5. Since the C.R esteem is under 10% (0.10) which is the standard irregularity esteem, in this way the AHP lattice is sensibly predictable and the created model's weight is displayed in Table 18.

From Table 18, it very well may be seen that use rate has the most elevated standards weight and accordingly is the main rule per the AHP investigation. These approved loads would now be utilized for the last advance of the AHP examinations.

In the subsequent stage, Table 19 was standardized by changing the lattice components over to 0 - 1. This was calculated by isolating every segment component by the best model's esteem on the section. The result of this standardization is displayed in Table 19.

The following stage was to duplicate the standardized qualities in every section of Table 19 with the relating measures weight of the segment. The result of this progression is displayed in Table 20.

To ascertain the general needs of the other options, the amount of the line components in Table 20 was taken. The outcome is displayed in Table 21.

Figure 4, represents that AHP places main concern on Pressure gauges, trailed by Control Systems with the least as Completions. This is comparable with the outcomes gotten utilizing TOPSIS examination, and not quite the same as the Pareto investigation result. Thus, the main two need items for inventory management of oil and gas companies are pressure gauge items and control systems.

4. Summary, Conclusion and Recommendations

4.1. Summary of Findings

This research applied various models in inventory management in oil and gas companies. The review was directed by five targets, which included to: recognize the materials/parts to be overseen as inventory in the organization, decide inventory models utilized by oil and gas companies in management of their loaded components, apply the inventory models, check the one that can keep up with inventory at suitable level to stay away from inordinate or lack of inventory limit investment in inventory at least level to augment productivity and make suggestions & proffer potential answers to lessen or wipe out wastages.

In the research, pertinent ideas are necessary, including however not restricted to: inventory management and inventory management model. The study concentrated explicitly on application of TOPSIS model, Pareto model and AHP model in the inventory management. From the outcomes, AHP places first concern with Pressure gauges, trailed by Control Systems. With the least as Completions. This is comparable with the outcomes obtained using TOPSIS investigation, and not quite the same as the Pareto examination result. Consequently, the two main needed items for inventory management of oil and gas companies are Pressure gauges and control systems.

4.2. Conclusion

From the results of the investigations, the following conclusion can be made. The AHP model spots main concern with pressure gauges, trailed by Control Systems.

This is comparable with the outcomes got utilizing TOPSIS investigation, and furthermore not the same as the Pareto examination result, which put the control systems as the most significant, with the most elevated utilization rate, trailed by pressure check. Hence, the two main needed items for inventory management of oil and gas companies are Pressure gauges and control systems.

Analysis with TOPSIS is possible for limitless arrangement of options against limitless arrangements of measures. The AHP model allows some minor irregularity in dynamic scenarios. However, there are a few pitfalls that accompany the utilization of AHP. Expansion or changes of rules and option impressively adjusts the results of examination utilizing AHP; TOPSIS gives more prominent deftness in the choice cycle than AHP as also reported by Alexandros *et al*. (2018).

4.3. Recommendations

The accompanying suggestions are summed up:

- Based on the discoveries and brief correlation of the specialized capacities of AHP and TOPSIS models in relative examination and inventory management, this review advances the TOPSIS model as the ideal and the most reasonable model for inventory management in the oil and gas industry.
- The present review utilized information from an Oil and Gas Organization, it is prescribed for different investigations to utilize information from different sources (i.e., other companies).

4.4. Contribution to Knowledge

The accompanying commitments to information are summed up:

- The discoveries from the review will help the scholarly community and different players in the oil and gas industry to settle on educated choices regarding inventory management in oil and gas industry.
- The study has additionally shown the various systems and models deployable for inventory management.
- The study has suggested the most feasible model for oil and gas inventory management – TOPSIS.
- Lastly, the review will fill in as an outlook material for specialists and different understudies with interests in comparative investigations of inventory model.

5. References

i. Alexandros, N., Haris D., & Luis, M., L. (2018). A group decision making tool for assessing climate policy risks against multiple criteria. Heliyon 4.
ii. Assari, A., Mahesh, T. & Assari, E. (2012). Role of public participation in sustainability of historical city: usage of TOPSIS method. *Indian Journal of Science and Technology*, 5(3), 2289-2294.
iii. Saaty, T. L. (1980). The Analytic Hierarchy Process. McGraw-Hill, New York.
iv. Serhii, Z. (2015). A literature review on models of inventory management under uncertainty, international journal on business systems and economics, 5 (1), 29-32.
v. Sharma, J. K. (2003). Operations Research (Second Edition): Theory and Applications, Macmillan India Ltd., New Delhi, India.

vi. Wai, P. W. (2010). Decision Support Model for Inventory Management Using AHP Approach: A Case Study on a Malaysian Semiconductor Firm. 50 – 55.