Selection of Proper Well Candidates for Well Intervention Job Using the AHP (Analytic Hierarchy Process) Method

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Abstract. Oil and gas wells are essential assets for oil and gas companies. However, this oil and gas production will naturally decline, especially if it has passed the peak stages of production. In addition to natural factors from the condition of oil and gas reserves on the earth, external factors also influence this decline, including well profile, location & flowline, and lifting. To maintain production figures, new wells are drilled, or existing wells are maintained through a well intervention job. This study was conducted in an oil and gas company field in Indonesia. In this field, oil production in 2019–2021 did not reach the predetermined target, only around 92–96% of the target. The reason is a natural decline and less successful well intervention work. In 2019–2021 there were 53 wells that experienced delays in completing their well intervention work. This resulted in an additional cost of $1,578.864.63. To avoid this, selecting the right candidate wells for well intervention work is necessary. The author uses a fishbone chart to find the root cause of the delay in completing the well intervention work. Furthermore, the author uses the AHP (Analytic Hierarchy Process) method to select candidate wells. The criteria used in the AHP method were obtained from the fishbone chart evaluation results. The analysis of the AHP method is a sequence of well candidates for well intervention work. The results of this analysis will be submitted to officials in the oil and gas company field as an alternative solution to solve problems that occur in the field.

Keywords: Oil Production · Decline · Well Intervention Job · Fishbone Chart · AHP

1 Introduction

One of the problems in this field is the oil production target that was not achieved during the 2019–2021 period. Based on Key Performance Indicator (KPI) data for 2019–2021, the achievement of oil production is around 92%–96%, as shown in Fig. 1. The failure to achieve the oil production target was caused by a natural decline in production and also the lack of success of the well intervention job that had been carried out. The well intervention job is the backbone of maintaining oil and gas production in this field, so a considerable decline does not occur. Naturally, oil and gas production will decrease. The decline in oil and gas production can be overcome by drilling new wells and well intervention jobs. However, there was no drilling job in this field during 2019–2021.

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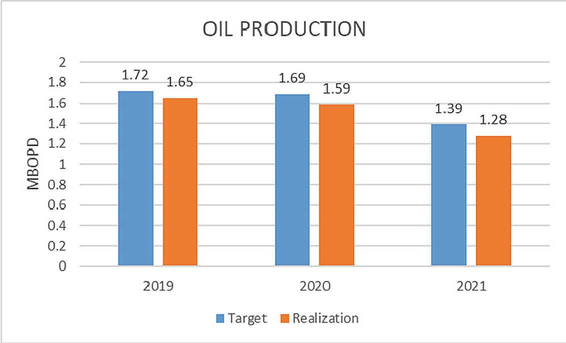

Fig. 1. Oil Production

The success rate of a well intervention job is influenced by sub-surface, surface, and operational conditions [1]. Determining the right candidate well will make the well intervention job effective and efficient so that maximum results can be obtained by producing oil and gas wells according to the targets that have been made.

1.1 Identify Problems

Based on data on the realization of well intervention jobs in 2019 and 2020, there were several well intervention jobs that had problems that caused the actual job to be slower than the planned duration of the day. The delay in completing the well intervention jobs on a well will impact the increase in costs and delays in producing oil or gas from the well. This additional cost is used for equipment rental, use of fuel (diesel oil), and the addition of other materials such as cement, KCL, and polymer.

Figures 2 and 3 show the number of wells where the completion of the well intervention job was delayed and the excess days wasted, as well as additional costs due to the delay. The number of wells that are delayed is decreasing from 2019–2021, but the number of wells that are delayed is still quite a lot, and this still consumes a lot of budgets and disturb well production. In 2019, 25 wells were delayed, costing $794,362.42 and an additional 138 days. In 2020 there were 19 wells with an additional cost of $263,094.63

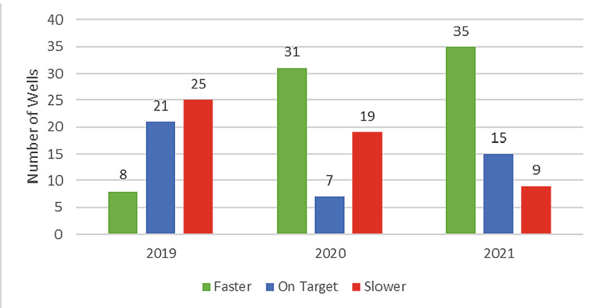

Fig. 2. Well Intervention Job Duration

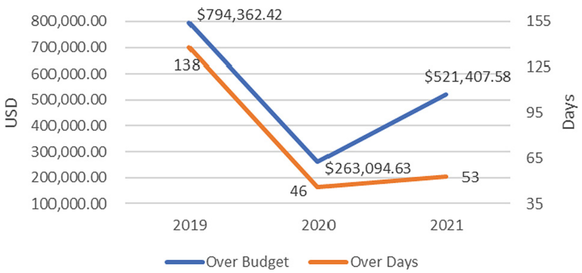

Fig. 3. Impact of Delay in Completion of Well Intervention Jobs

and an additional 46 days. Meanwhile, in 2021 the number of wells experiencing delays is reduced to only nine wells, but the additional days required are 53 days with an additional cost of $521,407.58. This shows operational problems that occur in the well, especially in 2021 (The operational difficulty of the well intervention job is relatively high, thus delaying the completion of the well).

1.2 The Factors Causing the Problem

In this study, the author will use 4M + 1E on the fishbone diagram, namely: Man, Material, Machine, Method, and Environment. From each criterion will be obtained the dominant causes of the problems. These dominant causes will be used as initial criteria in the AHP to obtain alternative solutions to the problems that occur in this study.

According to the results of the fishbone diagram analysis, as seen in Fig. 4, it was obtained that several items were the direct root cause of the delay in completion of the well intervention job. These items consist of:

1. Materials. The root cause for this item is the flowline. Damage condition of flowline or unavailability of flowline is the direct cause of delays in the completion of well intervention job.

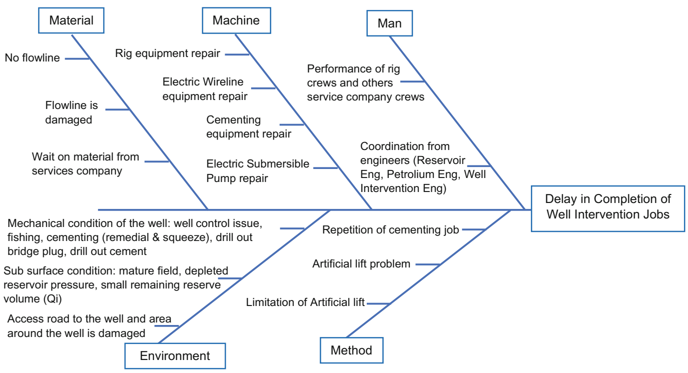

Fig. 4. Fishbone Diagram of Delay in Completion of Well Intervention Jobs

2. Method. The root cause for this item is lifting. Damage that often occurs in lifting causes the well to be delayed in producing so that the well intervention job is also delayed.
3. Environments. In this item, three factors become the root cause, namely the mechanical condition of the well (well profile), sub-surface condition (Qi) caused by mature field conditions, depleted reservoir pressure, and small remaining reserve, and the last is the condition of the well location including road access to the well location.
4. Man, and Machine. These two items did have an impact on delaying the completion of the well intervention work, but the impact did not directly affect the well.

1.3 AHP for Decision Making

The analytic hierarchy process consists of 3 steps:

1. Structure a hierarchy (Define the problem, determine the criteria and identify the alternatives). Create a hierarchy that describes a structure of the highest ranking that decreases to a lower level. The peak of the hierarchical structure contains the main problems that have been determined based on the analysis process that has been carried out. After determining the problem to be solved, determine the criteria related to the problem. The last part of the hierarchical structure contains the alternatives to be selected. In this study, the business issue was the delay in completing the well intervention work. After analyzing with fishbone chart, we obtained some roots of the laziness that led to the emergence of the issue. Based on these business issues, this study raises the issue of how to choose well candidates who will be carried out well intervention job using the AHP method so that the issue of delays in completing well intervention job can be reduced or even eliminated [2].

   Based on the causative factors obtained from the fishbone chart, factors that have a considerable influence on the success rate of well intervention work are divided into three categories: surface, sub-surface, and operational condition. The criteria represent the surface area location and flowline. Location is the condition of road access to a well and the condition of the location around the well area, while flowline is the availability of lines and line conditions to move oil and gas from the well to the production/collection station. The criteria representing the sub-surface are dominated by Qi (the condition of the remaining oil and gas reserves that will be the target of production of a well) and lifting (the method used to produce oil and gas from a well). Operational condition criteria are represented by a well profile (mechanical condition cross-section of a well that affects the difficulty level of a well intervention work). So, the criteria used in AHP in this study are location and flowline, production target (Qi), lifting, and well profile (mechanical condition of the well).
2. Make pairwise comparisons (Rate the relative importance between each pair of decision alternatives and criteria)

   The next step is to create pairwise comparisons to determine the priority of the criteria and the determined alternatives. This prioritization is done by providing value or weighting.
3. Synthesize the results to determine the best alternative (Obtain the final results).

   Make priorities, then compare each priority to make the order of these priorities based on the results of the weighting that has been done. The expected result is the priority order of the existing alternatives based on the weighting results of each of these alternatives.

1.4 Root Cause of Business Issue

From the explanation above, it can be concluded that the factors that have a direct impact on the completion of the well intervention job will be an essential component to be a factor in the selection of wells that will become candidates for well intervention jobs, namely Qi, well profile, lifting, flowline, and well location. These factors will be the criteria for making decisions using the AHP method.

2 Business Solution

2.1 Decision Structure

According to the fishbone diagram [3] analysis results regarding the delay in the completion of the well intervention job, it is necessary to select the right candidate well for the well intervention job. Based on this analysis, the authors build a hierarchical structure for AHP as follows:

1. Goal: Select well candidates for well intervention jobs.
2. Criteria:
   a. Qi: the oil and gas production target of a well from the results of well intervention job is adjusted to the remaining oil and gas reserves in the well. It is useless to do well intervention job in a well if there are no more oil and gas reserves in the well.
   b. Well profile: cross-sectional drawing of a well depicting the mechanical conditions in the wellbore. The more complicated the mechanical conditions in the wellbore will make completion of the well intervention job longer.
   c. Location and Flowline: doing well intervention job will need a lot of equipment such as rigs, cementing units, wireline units, stimulation units, coil tubing units, and chemicals to make completion fluid and cement. Heavy transportation is needed to mobilize the equipment. The well location and access road to the well must be in good condition so that it does not interfere with the mobilization process of all equipment and materials. At the same time, the flowline is needed to flow oil and gas from the wells that have been completed to the gathering station. It will be useless if the well has been completed, but the flowline is damaged or not even available. Oil and gas production from wells cannot be transported to the gathering station. It cannot increase production and cannot provide profits for the company.
   d. Lifting: If the reservoir pressure condition is low, then oil and gas cannot flow naturally to the surface, so an artificial lifting tool is needed to lift oil and gas to the surface. This field has mature conditions, so the reservoir pressure has significantly decreased. This requires selecting the right artificial tools to help lift oil and gas from the well to the surface.
3. Sub-criteria:
   a. Sub-criteria on Qi: the sub-criteria are determined based on the number of production targets that will be achieved when well intervention job has been completed on a well. The priority of the sub-criteria is from wells with the highest production target to wells with the lowest production. The sub-criteria are as follows:

- Qi > 50 bopd and Qi ≥ 1 mmscfd
- 30 bopd < Qi ≤ 50 bopd and 0.5 mmscfd < Qi < 1 mmscfd
- Qi ≤ 30 bopd and Qi ≤ 0.5 mmscfd

b. Sub-criteria on well profile: the sub-criteria based on the level of complexity of the mechanical conditions of a well. The priority ranges from the most straightforward mechanical to the most demanding conditions. The sub-criteria are as follows:

- No issue
- Remedial/squeeze cement, drill out cement, drill out bridge plug, hard to release packer
- Well control issue, fishing job

c. Sub-criteria on location and flowline: the sub-criteria are based on the condition of the access road to the well location, the condition of the location around the well, and the availability of the flowline. The priority is from the readiness of location and flowline to complex repair of location and flowline. The sub-criteria are as follows:

- Location and flowline are ready
- Need repair for the location or flowline
- Need repair for location and flowline

d. Sub-criteria on lifting: the sub-criteria are based on the condition of the flow of oil and gas from a well, whether it flows naturally or requires artificial lifting equipment. The sub-criteria are as follows:

- Natural flow
- Artificial lift without issue
- Artificial lift with issue

This structure can be seen in Fig. 5.

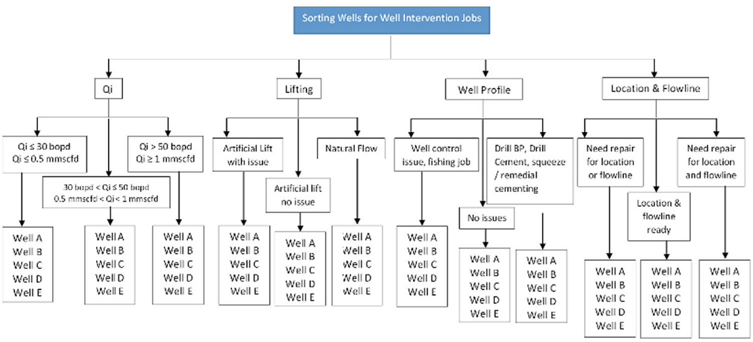

Fig. 5. AHP Structure of Sorting Well for Well Intervention Job

2.2 Data Collection

The data used for AHP analysis refers to the annual work plan data for the third quarter period for one rig, as seen in Table 1. From the work plan data, then data is made for AHP analysis based on predetermined criteria [4]. The well data and criteria for AHP analysis can be seen in Table 2. To make pairwise comparisons, the authors surveyed workers from several divisions related to well intervention jobs with diverse work experiences [5]. The Well Services Division, Exploitation Division, and Petroleum Engineering Division are the divisions [6]. The survey form can be seen in Table 3 and Table 4.

2.3 AHP Result

The following is the result of the AHP calculation (Fig. 6 and Tables 5, 6, 7, 8):

2.4 Conclusion of Business Analysis

1. The weight of the criteria in the hierarchy [7] dramatically influences the decision maker to make choices. Based on the four criteria that affect the success of the well intervention job, the Qi criterion (production target) has the most significant influence (55.9%), followed by well profile (24.6%), location and flowline (11.6%), and the one with the least effect is lifting (7.9%). The well with the highest score will be the top candidate for a well intervention job.
2. Consistency from pairwise comparison for each criterion. The degree of consistency exhibited in the pairwise comparison matrix for all criteria is acceptable (Consistency ratio for all criteria ≤ 0.1). This indicates that the determination of the weights against the criteria that the respondent has done is correct, so it can be concluded that the process of selecting well candidates for well intervention jobs can be executed.
3. Determination of well candidates based on weighting results. By combining the weighting results on the criteria and assessment of each well based on each criterion, wells with high Qi, easy (no issue in well profile) [8], and production facility readiness (location readiness and flowline availability) will be selected as primary candidates for well intervention jobs. The following is a sequence of wells candidates for well intervention job (Table 9):

Well-E is a top priority for well intervention job because this well has several strong points, namely:

- This well has the highest production target compared to other candidate wells. This well has a production target of 80 BOPD (Barrel Oil Per Day), 1 MMSCFD (Million Standard Cubic Feet per Day), Total production of 255 BOEPD (Barrel Oil Equivalent Per Day).
- Easier operational difficulty level than other wells, although not easier than Well-A.
- There are no issues related to the lifting method that will be used because this well is targeted to produce oil and gas naturally flow, so it does not require special lifting equipment.

The weak point of Well-E is that the flowline that will be used to flow oil and gas from the well still has to be repaired.

Table 1. The Quarter Period Annual Work Plan.

No	sumur	Job	Interval perfo target	Rig	Duration		Estimation & Realization Time		Target production				Explanation
					Mob	Ops	Start	Finish	Gross (bpd)	Oil (bpod)	KA (%)	Gas (mmscfd)	
14	Well-A	repair	Plan 1 preTAF (2758–2761, 2751–2754, 2741.5–2744.5 mMD) Plan 2 preTAF (2717–2720, 2706–2709, 2701–2704 MMD) Plan 3 preTAF (2664–2667, 2591–2594 mMD)	SSO HP	3	10	1 - Jul - 22	11 -Jul - 22	105	50	52.4%	0.8	1 Revoke the RPP 2 Run scrappers 3 RIH RPP Gas Lift, unload underbalances 4 PreTAF layer perforation with HSD TT 2” 5 Produce the well
	Well - B	repair	TAF-04 2468 2470 TAF-05 2483 2485	SSO HP	1.5	20	12 Jul 22	1 Aug 22	110	30	72.7%	0.3	1 Fishing Job 2 Squeeze intervals 2391–2393, 2398.5–2400, 2403–2404, 2406–2409 mMD 3 DOC per interval layer and IRT spi blong 4 Run Scrapper 5 Enter RPP gas lift UR at 2373 mMD 6 Unload underbalance
	Well - C	repair	Fract TAF-03 2465 2470 PreTAF 2664 2668 PreTAF 2798 2801 PreTAF 2844 2847 PreTAF 2865 2869	SSO HP	5	15	6 Aug 22	21 Aug 22	160	60	62.5%	1	1 Unplug RPP + Packer 2 BRF layer squeeze interval 2062–2068 mMD, UTS 3 DOC squeeze layer and IRT 4 DOC TOC 2257.62 mMD spi unfurled TOL 4.5” 5 Run Scrapper 7” 6 TAF-03 layer perforation interval 2465–2470 mMD with TCP 4.5 12 SPF with AGR 7 Produce the well

(*continued*)

Table 1. (*continued*)

No	sumur	Job	Interval perfo target	Rig	Duration		Estimation & Realization Time		Target production				Explanation
					Mob	Ops	Start	Finish	Gross (bpd)	Oil (bpod)	KA (%)	Gas (mmscfd)	
	Well - D	repair	2240–2242 mMD & 2245–2247 mMD	SSO HP	5	20	26 Aug 22	15 Sep	50	30	40%	0.5	1 Unplug RPP + Packer (Do tubing cutter & fishing if there are problems in the process of removing the packer) 2 Squeeze 2081.5–2084.5 mMD, UTS 3 DOC spi Blong and IRT 4 Run Scrapper spi 2400 mMD 5 PreTAF layer perforation interval 2240–2242 mMD & 2245–2247 mMD with TCP 4.5” 5 SPF Xtraadeep with AGR 6 Produce the well (Prepare Choke Install 9 mm and 11 mm chokes)
	Well-E	repair	Fract preTAF 2544–2548 2551.5–2556	SSO HP	1.5	13	17 Sep 22	30 Sep 22	160	80	50%	1	1 Unplug RPP + Packer 2 Plug Cement intervals Pre TAF 2557–2561 m, 2562–2564 m, 2562- 2567 m, 2573.5–2576.5 m, 2578.5–2581 m, UTS 3 DOC spi 2550md 4 Run scrappers 5 TAF-03 layer perforation 2417–2421 mMD with TCP 4.5” 12 SPF with AGR 6 Produce the well 7 Add perfo rigless TAF-05 2454–2461 mMD 8 Produce well

4. The reasons for the importance of ranking well candidates for well intervention job so that the problem of delay in completion of well intervention work can be overcome:

Table 2. Data of The Wells for Alternative for AHP

Well (Alternative)	Operation Risk	Surface Risk	Subsurface Risk	
	Well Profile	Location & Flowline	Qi	Liñing
Well – A	No Issue	Ready	50 bopd, 0.8 mmscfd, Total 190 boepd	Gas Liñ
Well – B	Fishing job, Cement Squeeze, Drill out cement	Ready	30 bopd, 0.3 mmscfd, Total 82.5 boepd	Gas Liñ
Well – C	Possibility hard to release packer, Cement squeeze and Drill out cement	Ready	60 bopd, 1 mmscfd, Total 235 boepd	Natural Flow
Well – D	Possibility hard to release packer, Cement Squeeze and Drill out cement	Ready	30 bopd, 0.5 mmscfd, Total 87.5 boepd	Natural Flow
Well – E	Cement squeeze and Drill out cement	Need repair for flowline	80 bopd, 1 mmscfd, Total 255 boepd	Natural Flow

Table 3. Survey Form for Criteria of AHP

\	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well Profile
Qi	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Lifting
Qi	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Location and Flowline
WellProfile	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Lifting
WellProfile	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Location and Flowline
Lifting	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Location and Flowline

Selection of the right candidate wells will make the well intervention job run effectively (on time) and efficiently (on a budget) so that the annual work plan can be appropriately realized.

Selection of suitable candidate wells with large production targets and manageable operational levels according to the results of AHP calculations will accelerate the addition of oil and gas production.

Table 4. Survey Form for Alternatives of AHP

		Numerical Rating Importance																		
Qi	Production target from the well with the biggest production to the smallest	Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-B
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-D	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
Well Profile	The mechanical condition of well from the easiest operational well intervention job to the hardest	Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-B
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-D	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
Location and Flowline		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-B
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-D	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E

(*continued*)

Table 4. (*continued*)

		Numerical Rating Importance																		
Lifting		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-B
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-C
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-B	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-D
		Well-C	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E
		Well-D	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Well-E

Table 5. Priority Ranking of Criteria

Criterion	
Qi	0.559
Lifting	0.079
Well Profile	0.246
Location and Flowline	0.116

Table 6. Weight Calculation for Each Alternatives Base on Criterion

Alternative	Criteria			
	Qi	Lifting	Well Profile	Location Flowline
Well-A	0.141	0.141	0.543	0.284
Well-B	0.036	0.122	0.049	0.273
Well-C	0.248	0.209	0.090	0.216
Well-D	0.519	0.244	0.231	0.043

Selection of the right candidate well will increase the number of well intervention jobs that can be completed on time.

Table 7. Result of Consistency Ratio

Objective	Path	CR
Criteria	Criteria	0.018754
Qi	Criteria I Qi	0.095229
Well Profile	Criteria I Well Profile	0.024722
Location and Flowline	Criteria I Location and Flowline	0.007509
Lifting	Criteria I Lifting	0.003740

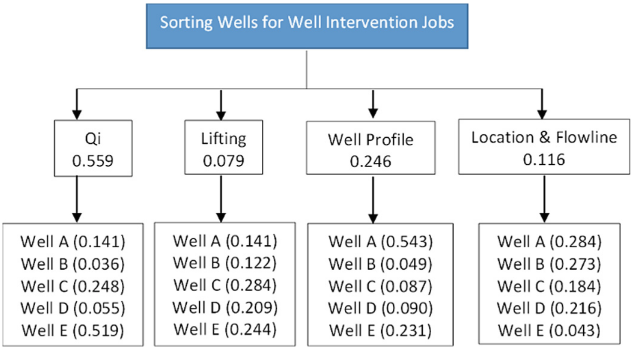

Fig. 6. Result of Hierarchy Process for Sorting Wells for Well Intervention Job

Table 8. Final Results of Priority Order of Well Candidates for Well Intervention Job

Rank of Criteria									
Alternative	Criteria					Criteria Weights		Well Ranking	
	Qi	Lifting	Well Profile	Location and Flowline					
Well-A	0.141	0.141	0.543	0.284	x	0.559	Qi	0.256	Well-A
Well-B	0.036	0.122	0.049	0.273		0.079	Lifting	0.074	Well-B
Well-D	0.55	0.209	0.090	0.216		0.116	Location and FLowline	0.095	Well-D
Well-E	0,519	0.244	0.231	0.043				0.371	Well-E

Table 9. The rank of Well Candidates for Well Intervention Job

1	Well-A	0.256366
2	Well-B	0.073663
3	Well-C	0.204049
4	Well-D	0.094699
5	Well-E	0.371223

3 Conclusion

1. Based on the results of the fishbone diagram analysis about the causes of delay in completion of well intervention jobs, three factors influence the success of well intervention jobs, namely material, method, and environmental factors. The materials factor is caused by the flowline condition. Damage to the flowline or the unavailability of the flowline will hinder the process of sending oil and gas from a well to the gathering station. The factor method is caused by lifting oil and gas from the well to the surface. The condition of the well pressure has decreased, causing oil and gas cannot flow to the surface naturally, thus requiring an artificial lifting tool. Frequent damage to lifting equipment and the wrong type of artificial lifting causes the production of a well to be hampered. The last factor is the environment caused by the mechanical condition of the well (well profile), the condition of oil and gas reserves in the well (Qi/production target), and the condition of the location around the well, including the access road to the well. The more complex mechanical conditions of the well will cause the completion time of the well intervention job to be longer. The decline in oil and gas reserves will cause well intervention jobs to become increasingly uneconomical, while the damage conditions of the location around wells will hamper the equipment mobilization process.
2. Based on the results of the AHP analysis where Qi (production target) has a role of 55.9%, Well Profile 24.6%, Location and Flowline 11.6%, and Lifting 7.9%, so choosing the right candidate well for well intervention job is select wells based on the order of priority: Qi (production target) – well profile – location and flowline – lifting. Well candidates are selected based on wells with large production targets with large oil and gas reserves, easy well profile conditions for completion of well intervention job, supported by good location and access road conditions to wells, availability of flowlines or good flowline conditions, and high reservoir pressure condition so that it does not require an artificial lifting method (flow naturally).

4 Implementation Plan

The following is the timeline for the implementation plan for selecting candidate wells for well intervention jobs according to the results of the AHP analysis.

Figure 7 is the s-curve of the Annual Work Plan for well intervention jobs in 2022. The blue line is the work plan that has been made, while the red line is the realization of the work that has been done. The annual work plan for 2022 was made in March 2021

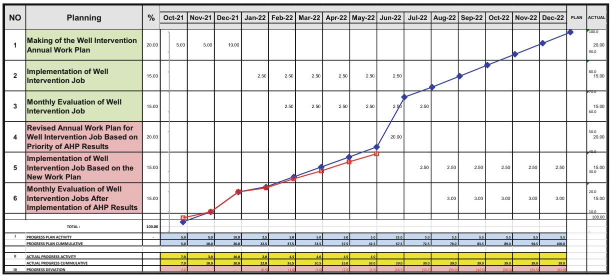

Fig. 7. S-Curve of the Annual Work Plan for Well Intervention Job 2022

and was finalized in October–December 2021. Activities no. 1–3 (green) are activities that should be carried out until the end of 2022, but due to the implementation plan of the results of the AHP analysis, activities no. 1–3 are only carried out until June 2022. Activities no. 4–6 (pink) are activities after the implementation of the results of the AHP analysis. June 2022 is a transition period to implement the results of the AHP analysis. In June, there was a change in the well intervention work plan for semester 2 of 2022 (July–December 2022). The red line shows the realization that has been carried out until May, but there is still a gap between the blue line and the red line. This shows that work plans still have not been appropriately implemented. In the January–May period, well intervention work was still experiencing delays. With the implementation of the analysis of AHP results in the second semester, it is expected to be able to catch up with delays that occur in the first semester.

The S-curve is critical in the 2022 work plan because it is one of the field's key performance indicators of the Well Services division. If the realization of the s-curve is not achieved 100%, it will be a bad assessment for workers in the Well Services division. Efforts to realize the plan on the s-curve will also help to maintain oil and gas production and are even expected to increase oil and gas production.

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