JARES, Vol. 7 No. 2 September, 2022; p-ISSN: 2502-826X; e-ISSN: 2503-1163
Copyrights@ Balitar Islamic University, Blitar, Indonesia;
https://ejournal.unisbablitar.ac.id/index.php/jares

JARES (Journal of Academic Research and Sciences), (7)2, page 32-42.

RISK MANAGEMENT IN SLICKLINE FISHING OPERATIONS: A DELPHI STUDY

Tri Novaldi[1], Muhammad Asrol[2]

[1]Industrial Engineering Department, BINUS Graduate Program – Master of Industrial
[2]Engineering, Bina Nusantara University, Jakarta, 11480, Indonesia
E-mail: Muhammad. asrol@binus.edu

ABSTRACT

Slickline fishing, as a result of undesired event, is economically preferable compared to workover. However, the fact that it does not always end with success but also worsened situation making it a risk management strategy. This research aims to manage the risk during normal slickline to avoid fish and while performing fishing operations using three-round Delphi study to conduct risk identification and to determine countermeasures by asking panel of selected experts. The results revealed that nine risks to be prioritized in Slickline operations to avoid fishing situation and four less prioritized risks to be considered. It has also revealed that 12 risks to be prioritized during fishing operations to avoid ending up in worse situation and five prioritized risks to be considered. The Delphi reached consensus on 12 countermeasures to be prioritized in Slickline operations to avoid fishing situation and 14 important factors for successful fishing operations.

Keywords: *Consensus, Delphi, Fishing, Risk Management, Slickline*

1. INTRODUCTION

Fishing is one of the last things people want to hear in slickline operations. In oilfield operations, fishing is defined as the technique of removing lost or stuck objects from the wellbore (DeGeare, 2014). The same definition is applied for fishing in slickline operations. Weatherford on their Wireline Operations Manual define fishing as any operation to remove undesirable objects from the well bore (Weatherford, 2003). Scenarios of fishing jobs are in a very broad range from simple, straightforward fishing jobs, such as recovery of tool string or parted wire, etc., to more complicated jobs, such as recovery of broken locks, stuck tools and wire, wireline blown up hole, etc. Most of them present special problems that require proper analysis, creative thinking, and good judgment.

One of oil companies in Middle East had to suffer with 45 out of 8,124 slickline operations ended up with fish. As a result of an undesired event, fishing is considered liability from the very first time it is started. The available options in fishing situation are usually to proceed with fishing operations or workover (Trujillo, et al., 2010), yet the latter option is not considered attractive economically. The figure of $ 2,000 for routine slickline operation versus $ 15,000 for onshore workover rig are cost per day to show the economic justification. Therefore, fishing operation is preferable as long as the objective is achieved. The company remedied the fish with 103 days of Slickline fishing operations, most of which were successful yet three fish could not be recovered and ended up with workover.

Plans can be carefully formulated to avoid fishing, yet unpredictable factors are possible to come during the operations. To name a few, human error, unknown

downhole conditions, wire fatigue, junk in the hole, and faulty equipment. All of these are hazards and risks that need to be identified carefully.

Successful fishing job can save a well. On the other side failure of execution may lead to worse consequences, commonly known in oil and gas industry as consequence to personnel, environment, and assets (Vinnem, 2014). Therefore, fishing can be further considered as a risk management strategy to ensure that adequate measures are taken (Aven & Vinnem, 2007).

It is generally agreed that most causes that may lead to fishing situation are preventable, as well as the causes that may worsen fishing situation should fishing operation is the option to proceed. However, determining which risks and prevention methods are most important for both situations remain elusive. Risk identification is suggested to be considered as the single most significant activity of the risk management (Renault, et al., 2016) as risks must be identified in order for them to be control or mitigated. Enhancement in risk identification leads to reduction in risk exposure that is paramount instrument to improve performance.

Comprehensive recommendations for using risk identification tools are presented in the ISO 31010 "Risk management – Risk assessment techniques" standard (ISO, 2019). Some of the strongest applicable indicated are Brainstorming, Structure or semi-structured interviews, Delphi, Checklists, and SWIFT.

Slickline operations, like any other operations in oil and gas industry, are equipped with Job Safety Analysis (JSA), often referred to as Job Hazard Analysis, as part of Permit to Work (PTW) system. Occupational Safety and Health Organization in OSHA 3071 defines it as "a technique that focuses on job tasks as a way to identify hazards before they occur" (OSHA, 2002). The process can be broken down into selecting the job, breaking down each job into sequences, identifying potential hazards, assessing the risks, and developing preventive measure to overcome the hazards (EHS Insight Resources, 2019).

Typically, JSA is developed by a group of experienced workers and supervisors who complete the analysis through brainstorming. While this method offers superiority over the others, it also suffers from several disadvantages. Some issues attached are ideas can lack quality due to focusing on quantity (Symanowitz, 2020), homogenous team leading to hazy ideas, and creative ideas do not come on command (van Valin, 2014). This finding was arising during initial study conducted by a group of three Slickline supervisors in Well Services department of a leading oil company in Middle East.

Considering the severity of consequences fishing operations may result in compared to other routine slickline operations, the group study argues that slickline fishing operations shall be treated differently as it requires more experts to be involved in both quantity and quality aspects. With several attributes attached to it e.g. full anonymity, iterated feedback, ability to identify "deeply uncertain risks", higher quality risks identified by panel of experts, and risk ranking capability (Baumann, et al., 2016), Delphi technique has huge potential to offer that some has utilized and benefited from it across different sectors such as human resources (Colton & Hatcher, 2004), health (van der Linde, et al., 2005, Kim, et al., 2020, Nurek, et al., 2021, Shi, et al., 2021), supply chain (Markmann, et al., 2013), tourism (Jones, et al., 2013), social science (van de Linde & van der Duin, 2011, Hefferan & Wardner, 2012, Goula, 2013), information science (Gotay, 2020, Haynes & Robinson, 2021), food industry (Post, et al., 2011),

telecommunication (Giannarakis, et al., 2011), and education (Lam, et al., 2021).

This study aims to manage risks in Slickline fishing operations. While more traditional risk management, particularly in oil and gas industry, uses one method to identify hazard and another method to assess the risk and to find control measures this study proposes alternate approach by utilizing the Delphi technique to answer pre-determined research questions through the identification of a consensus opinion across slickline experts in fishing operations. Those include identifying the hazards, assessing the risks by prioritizing them and finding measures to control the assessed risks.

2. METHODOLOGY

The Delphi technique is based on rounds of questions. The first round involves open-ended questions asked to a panel of experts. In this study a set of four open-ended questions were asked to a panel of selected experts through interview sessions. Two out of three stages of Risk Management Framework (Proag & Proag, 2014), before disaster and during the event, were covered within the four questions regarding identified risks and counter measures on each phase. Researcher compiled responses from each panellist and developed a comprehensive list of those.

The second round of Delphi in this study involved sending a copy of the comprehensive list of responses from the first round to the experts. For this second round, the experts were asked to rate their agreement on each response submitted by all members of panel from the first round. Their responses were then returned to the researcher to be compiled and processed. Data processing on this round included mean calculation for each response which begun the consensus building of phase of the Delphi.

The processes data indicating group responses and collective rate of agreement from the second round were sent back to all panellists for the third round of Delphi. This round provided experts an opportunity for them to review the preliminary group consensus confidentially, to receive collective feedback from other experts, to compare those with their owns and to make any changes should they feel necessary. Responses from this last round were returned to the researcher who then process them and made a final compilation, thus representing consensus among experts.

3. RESULT AND DISCUSSION

Having sourced candidates of panellist, a total of 30 experts on Slickline fishing were contacted and invited to participate in this Delphi study. As many as 21 experts were identified as personal contacts of researcher, five experts were identified from professional network and four were nominated by other experts (snowballing). The invitation was then sent to each potential panellist contained a cover letter and three descriptions: 1. Short description of the study; 2. Consent form; and 3. Fill-out form to measure the expertise level of panellists.

Two weeks after 30 invitations were sent, 24 replies were received indicating agreement to participate in the Delphi survey. Reminders were sent to the other six yet no reply.

Having checked the fill-out forms, it was revealed that three out of 24 did not meet the pre-determined criteria: two failed to meet the third criteria (minimum 10 fishing operations) and one failed to meet two criteria as having less than 10-year experience in slickline and less than 10 fishing operations. Thus, a total of 21 experts were eligible to participate in Delphi round 1.

Interview schedule was then set up for each of 21 panellists with their preference of time. A span of three weeks was required to complete all interview sessions as each panellist was occupied with their jobs, mostly on rotation basis.

A. Delphi Round 1

Round 1 of the Delphi study was begun with a set of four open-ended questions that allows panellists to generate ideas. All 21 participants were interviewed and asked with four questions: 1. What do you identify as causes of fish? 2. What do you recommend preventing fishing situation? 3. Should fishing operations have to be carried out, what do you identify as situation/condition/behaviour that may lead to worse fishing situation? and 4. What do you identify as the most contributing factors for successful fishing operation?

Due to the type of questions, it was expected that participants would give different wordings in response. Having recorded all responses from the interview sessions, a set of response categories were then identified to group those replies that were part of the same theme.

The number of responses submitted by panellists differs between questions. Experts submitted two to eight responses for question 1, two to six for question 2 and one to six for both question 3 and question 4. Experts' responses on risks are consistently greater than their responses on countermeasures, indicated by mean value of question 1 of 4.10 compared to mean value of question 2 of 3.43 and mean value of question 1 of 3.43 compared to mean value of question 2 of 3.00. It implies that experts believe that several risks may be controlled by one countermeasure.

From question 1, a total response of 86 with an average of 4.1 responses per participant was recorded and consolidated. The responses and frequency indicated in the bracket were: Tool failure/poor condition (15); Differential pressure (12); Shortcut, not comply with procedure, over speeding, rushing (11); Well condition (11); Lack of skill, knowledge, experience (10); Losing focus (5); Incomplete/misleading information in program (4); Miscommunication (4); Poor wire log (4); Not paying attention to details, careless (3); Long period of plug set inside well (2); Surface & subsurface equipment malfunction (2); Wire type not suitable with well characteristics (2); and Underestimate (1).

From question 2, a total response of 72 with an average of 3.43 responses per participant were gathered and classified. The responses and frequency indicated in the bracket were: Check list (14; Competence development, training (10); Compliance to procedure, limitation (11); Operator awareness, careful, regular weight check (8); Wire log, test (7); Proper programming, detailed information, history check (5); Standard of tools & equipment, maintenance (5); Good communication (3); Stop for risk, ask if in doubt, immediate report on abnormalities (3); Toolbox Talk (3); Lesson learned Database, post job review (2); and Good supervision(1).

From question 3, a total response of 72 with an average of 3.43 responses per participant were gathered and classified. The responses and frequency indicated in the bracket were: Poor fishing tools & equipment, improper (10); Rushing (9); Wrong steps, calculation (7); False report of fish, incomplete (6); Not fully understand of fish background, insufficient knowledge (6); Poor fishing plan (4); Dispute between operator & supervisor (3); Execute fishing without reporting (3); Inexperienced crew (3); Insufficient tools (3); Over tension on wire (3); Stress, pressure to complete (3); No slip & cut on wire after long period of jarring (3); Well condition, buried by sand, debris (3); Overconfident or pessimistic (2); Not powerful unit, wire size (2); Poor supervision (1); and Worn-out fish neck (1).

From question 4, a total response of 69 with an average of three responses per participant were gathered and classified. The responses and frequency indicated in the bracket were: Reward policy (9); No blame culture (7); Proper planning covering all expected scenarios (7); Powerful unit (6); Tools & equipment availability (6); Complete and accurate history of fish, verified (4); Bigger wire (3); Clear instruction, single source (3); Fishing specialist, more experienced, more skillful (3); Fishing tools

with releasing mechanism (3); Function/pressure test on tools & equipment (3); Same crew that creates fish and execute fishing operation (3); Sufficient crew for long operations (3); Sufficient time, no rush (2); Calm, be ready for any consequence (2); Make sure all wire cleared out prior to latching on tool string (2); Capability to modify fishing tools (1); and Joined operator (1).

B. Delphi Round 2

Round 2 of this Delphi study was started by preparing online survey on which consolidated responses from the first round were sent to all panelists to rate their agreement on 1 to 5 Likert scale gradually from strongly disagree to strongly agree.

A set of four tables and detailed instruction were then sent to all panelists with the request to reply in a span of two-week time. 16 out of 21 panelists sent their replies with rates of agreement on each response consolidated from the first round at the end of indicated time. Reminders were sent to the other five participants yet none of them replied having been waited for one week. All responses that had been received were then processed.

From question 1, rate of agreement regarding causes of fish in slickline operations from panellists can be seen on Table 1.

Responses	Mean
Tool failure/poor condition	4.313
Differential pressure	4.250
Lack of skill, knowledge, experience	4.250
Not paying attention to details, careless	4.188
Well condition (sand, debris, wax, scale, cross flow)	4.188
Losing focus	4.125
Shortcut, not comply with procedure, over speeding, rushing	4.125
Wire type not suitable with well characteristics	4.125
Miscommunication	4.000
Poor wire log	3.938
Surface & subsurface equipment malfunction	3.875
Incomplete/misleading information in program	3.750
Underestimate	3.625
Long period of plug set in hole	3.250

Table 1. Responses to question#1 - Delphi round#2

It shows panellists indicated their agreement to most of the causes of fish, that is nine of 14. This left causes at bottom five, with mean less than 4.00, indicating panellists did not come to agreement on them as causes of fish in slickline operations.

From question 2, rate of agreement regarding recommended countermeasures to avoid fishing situation from panellists can be seen on Table 2. All panellists indicated their agreement to all countermeasures to prevent fish with all responses having mean value higher than 4.00.

Responses	Mean
Proper programming, detailed information, history check	4.625
Stop for risk, ask if in doubt, immediate report on abnormalities	4.563

Wire log, test	4.563
Operator awareness, careful, regular weight check	4.500
Toolbox talk	4.500
Competence development, training	4.438
Standard of tools & equipment, maintenance	4.438
Compliance to procedure, limitation	4.375
Good communication	4.375
Good supervision	4.375
Lesson learned database, post job review	4.375
Check list implementation	4.313

Table 2. Responses to question#2 - Delphi round#2

From question 3, rate of agreement situation/condition/behaviour that may lead to worse fishing situation from panellists can be seen on Table 3.

Responses	**Mean**
Poor fishing tools & equipment, improper	4.625
Wrong steps, calculation	4.563
Poor fishing plan	4.500
False report of fish, incomplete	4.438
Inexperienced operator/crew	4.438
Not fully understand of fish background, insufficient knowledge	4.438
Rushing	4.313
Insufficient tools	4.250
Over tension on wire	4.250
Well condition, buried by sand, debris	4.188
Execute fishing without reporting	4.000
Less powerful unit, wire size	4.000
No slip & cut on wire after long period of jarring	4.000
Stress, pressure to succeed	3.938
Overconfident or pessimistic	3.875
Worn-out fish neck	4.625
Poor supervision	4.563
Dispute between operator & supervisor	4.500

Table 3. Responses to question#3 - Delphi round#2

Like responses to question 1, panellists indicated their agreement to most of situation/condition/behaviour that may lead to worse fishing situation. This left 5 out of 18 hazards with mean value less than 4.00 indicating panellists did not come to agreement on them.

From question 4, rate of agreement the most contributing factors for successful fishing operation from panellists can be seen on Table 4. It shows that panellists indicated their agreement to 13 of 18 contributing factors for successful fishing operation. This left five out of 18 factors with mean value less than 4.00 indicating panellists did not come to agreement on them.

Responses	**Mean**
Complete and accurate history of fish, verified	4.813
Make sure all wire cleared out prior to latching on T/S	4.813
Tools & equipment availability	4.750

Fishing tools with releasing mechanism at all times	4.563
Proper planning covering all expected scenarios	4.563
Fishing specialist, more experienced, more skillful	4.500
Function/pressure test on tools & equipment	4.500
Sufficient time, no rush	4.500
Sufficient crew for long operations	4.375
Calm, be ready for any consequence	4.313
No blame culture	4.250
Clear instruction, single source	4.188
Powerful unit	4.063
Bigger wire	3.875
Capability to modify fishing tools	3.875
Joined operator, operator that create fish and fishing specialist	3.750
Reward policy	3.563
Same crew that creates fish and execute fishing operation	3.125

Table 4. Responses to question#4 - Delphi round#2

C. Delphi Round 3

Round 3 of this Delphi study was started by preparing online survey on which consolidated responses from the second round with mean value and their previous individual responses were sent to all panellists to give them opportunity to change their responses.

From question 1, panellists' rate of agreement regarding causes of fish in slickline operations are shown on Table 5.

Responses	Mean	IQR	4-5 [%]	SD	CV
Tool failure/poor condition	4.375	1.00	100	0.500	0.114
Differential pressure	4.313	1.00	88	0.870	0.200
Lack of skill, knowledge, experience	4.438	1.00	100	0.512	0.115
Not paying attention to details, careless	4.188	1.00	94	0.750	0.179
Well condition (sand, debris, wax, scale, cross flow)	4.188	1.00	88	0.655	0.156
Losing focus	4.188	1.00	81	0.750	0.179
Shortcut, not comply with procedure, over speeding, rushing	4.125	1.00	88	1.025	0.248
Wire type not suitable with well characteristics	4.125	1.00	88	0.806	0.195
Miscommunication	3.875	0.00	81	0.885	0.228
Poor wire log	3.813	0.00	81	0.655	0.172
Surface & subsurface equipment malfunction	3.813	0.00	81	1.047	0.275
Incomplete/misleading information in program	3.813	0.00	81	0.655	0.172
Underestimate	3.688	0.25	75	1.014	0.275
Long period of plug set in hole	3.375	1.00	50	0.957	0.284

Table 5. Responses to question#1 - Delphi round#3

It shows that panellists gave higher rate of agreement on most of the causes of fish compared to what they gave on previous round as shown on Table 1 hence the increased values. All panellists agreed on "Tool failure/poor condition" and "Lack of skill, knowledge, experience" shown by 100% value on responses scoring 4 and 5. Other causes were rated above the threshold value of 75%. Yet, one cause "Miscommunication" was given lower rate of agreement indicated by mean value dropping from 4 on previous round to become 3.875 on this round. However, it is shown that other parameters related to this cause indicate consensus among the panellists. This is also the common case for causes: "Poor wire log", "Surface & subsurface equipment malfunction", "Incomplete/misleading information in program" and

"Underestimate", with mean value less than 4 but other measures indicate nothing but consensus.

In the other hand, it also shows that panellists did not come into consensus to "Long period of plug set in hole" as cause of fish with mean value less than 4 and only 50% of panellists indicate their agreement on the cause. This implies some experts found cases where plug became fish after set in hole for too long while some others believed that other causes contribute to the process such as well condition.

From question 2, panellists' rate of agreement regarding recommended countermeasures to avoid fishing situation can be seen on Table 6.

Responses	Mean	IQR	4-5 [%]	SD	CV
Proper programming, detailed information, history check	4.625	0.25	94	0.806	0.174
Stop for risk, ask if in doubt, immediate report on abnormalities	4.625	1.00	100	0.500	0.108
Wire log, test	4.563	1.00	100	0.512	0.112
Operator awareness, careful, regular weight check	4.563	1.00	100	0.512	0.112
Toolbox talk	4.563	1.00	100	0.512	0.112
Competence development, training	4.563	1.00	100	0.512	0.112
Standard of tools & equipment, maintenance	4.563	1.00	100	0.512	0.112
Compliance to procedure, limitation	4.375	1.00	100	0.500	0.114
Good communication	4.375	1.00	100	0.500	0.114
Good supervision	4.375	1.00	100	0.500	0.114
Lesson learned database, post job review	4.313	1.00	100	0.479	0.111
Check list implementation	4.250	1.00	94	0.577	0.136

Table 6. Responses to question#2 - Delphi round#3

It shows that there are not many changes on the responses compared to those panellists gave on previous round. They came into consensus to all countermeasures to prevent fish by indicating "Agree" or "Strongly agree" to most of the causes. This left only two causes, "Proper programming, detailed information, history check" and "Check list implementation" with value less than 100%.

From question 3, panellists' rate of agreement regarding situation/condition/behaviour that may lead to worse fishing situation are listed on Table 7. It shows that despite higher rate of agreement panellists gave on most of situation/condition/behaviour that may lead to worse fishing situation, they still did not come into consensus on "Dispute between operator & supervisor". With mean value of 3.813, only 69% of panellists indicated their agreement on this potential hazard during fishing operations.

Responses	Mean	IQR	4-5 [%]	SD	CV
Poor fishing tools & equipment, improper	4.688	1.00	100	0.479	0.102
Wrong steps, calculation	4.625	1.00	100	0.500	0.108
Poor fishing plan	4.500	1.00	100	0.632	0.141
False report of fish, incomplete	4.500	1.00	100	0.516	0.115
Inexperienced operator/crew	4.500	1.00	94	0.632	0.141
Not fully understand of fish background, insufficient knowledge	4.563	1.00	94	0.629	0.138
Rushing	4.313	1.00	94	0.602	0.140
Insufficient tools	4.250	0.25	100	0.447	0.105
Over tension on wire	4.375	1.00	94	1.025	0.234
Well condition, buried by sand, debris	4.125	0.25	88	0.619	0.150

Execute fishing without reporting	3.938	1.00	81	1.124	0.285
Less powerful unit, wire size	3.875	0.00	88	0.885	0.228
No slip & cut on wire after long period of jarring	4.125	1.00	94	0.957	0.232
Stress, pressure to succeed	3.938	1.25	75	0.998	0.253
Overconfident or pessimistic	3.938	0.00	81	0.772	0.196
Worn-out fish neck	3.625	0.25	81	0.719	0.198
Poor supervision	3.813	0.50	75	1.047	0.275
Dispute between operator & supervisor	3.813	1.00	69	0.655	0.172

Table 7. Responses to question#3 - Delphi round#3

From question 4, panellists' rate of agreement regarding the most contributing factors for successful fishing operation are listed in Table 8. It shows that panellists did not come into consensus on the bottom four mentioned as contributing factors for successful fishing operation. However, they eventually came into consensus on "Bigger wire" as one contributing factor, with threshold values 4 and 75% respectively on mean and percentage of panellists indicating "Agree" and "Strongly agree".

Responses	**Mean**	**IQR**	**4-5 [%]**	**SD**	**CV**
Complete and accurate history of fish, verified	4.875	0.00	100	0.342	0.070
Make sure all wire cleared out prior to latching on T/S	4.813	0.00	100	0.403	0.084
Tools & equipment availability	4.813	0.00	100	0.403	0.084
Fishing tools with releasing mechanism at all times	4.625	1.00	94	0.619	0.134
Proper planning covering all expected scenarios	4.625	1.00	100	0.500	0.108
Fishing specialist, more experienced, more skillful	4.500	1.00	100	0.632	0.141
Function/pressure test on tools & equipment	4.500	1.00	100	0.516	0.115
Sufficient time, no rush	4.625	1.00	100	0.500	0.108
Sufficient crew for long operations	4.500	1.00	100	0.516	0.115
Calm, be ready for any consequence	4.438	1.00	100	0.512	0.115
No blame culture	4.375	1.00	100	0.500	0.114
Clear instruction, single source	4.313	1.00	94	0.602	0.140
Powerful unit	4.188	1.00	88	0.655	0.156
Bigger wire	4.000	0.50	75	0.730	0.183
Capability to modify fishing tools	3.875	2.00	69	1.088	0.281
Joined operator, operator that create fish and fishing specialist	3.938	1.25	69	0.772	0.196
Reward policy	3.750	1.00	63	0.856	0.228
Same crew that creates fish and execute fishing operation	3.250	1.00	31	1.125	0.346

Table 8. Responses to question#4 - Delphi round#3

Panellists disagreed to proceed fishing with "Same crew that creates fish and execute fishing operation" with only 31.25% of them scored 4 and 5. While they also disagreed to proceed with "Joined operator, operator that create fish and fishing specialist" as indicated by 69% of them scored 4 and 5, lower than the threshold value of 75%. The preferred option is to proceed with "Fishing specialist, more experienced, more skilful" indicated by 100% % of them scored 4 and 5.

4. CONCLUSIONS

This study utilized the Delphi method to develop consensus of the risks to be anticipated during slickline operations that may lead to fishing situation and during slickline fishing that may lead to worse situation. The method was also used to

determine the countermeasures to prevent fish in slickline operations and the important factors for successful fishing operations.

The experts who served on this study were those who are currently working for either operating company or service company with minimum ten years of experience in Slickline operations and having been involved in at least five fishing operations. 21 experts, out of 30 who were invited, serve on the Delphi panel at the first round and 16 panellists remained on it at the second and last round of the study.

"What are the risks to be anticipated during slickline operations that may lead to fishing situation and during slickline fishing that may lead to worse situation?"

This study reveals that at least 9 risks to be prioritized in Slickline operations to avoid fishing situation. Those risks are Tool failure/poor condition; Lack of skill, knowledge, experience; Not paying attention to details, careless; Differential pressure; Well condition; Shortcut, not comply with procedure, over speeding, rushing; Wire type not suitable with well characteristics; Losing focus; and Miscommunication.

Risks that were not prioritized were also considered to be anticipated in Slickline operations. Those risks are: Poor wire log; Surface & subsurface equipment malfunction; Incomplete/misleading information in program; and Underestimate.

It also reveals that at least 12 risks to be prioritized during fishing operations to avoid ending up in worse situation. Those risks are: Poor fishing tools & equipment, improper; Wrong steps, calculation; Poor fishing plan; False report of fish, incomplete; Insufficient tools; Inexperienced operator/crew; Not fully understand of fish background, insufficient knowledge; Rushing; Over tension on wire; No slip & cut on wire after long period of jarring; Well condition, buried by sand, debris; and Less powerful unit, wire size.

Risks that were not prioritized were also considered to be anticipated during slickline fishing that may lead to worse situation. Those risks are: Overconfident or pessimistic; Worn-out fish neck; Execute fishing without reporting; Stress, pressure to succeed; and Poor supervision.

"What are the countermeasures to prevent fish in slickline operations and the important factors for successful fishing operations?"

This study reveals that 12 countermeasures to be prioritized in Slickline operations to avoid fishing situation. Those countermeasures are: Proper programming, detailed information, history check; Stop for risk, ask if in doubt, immediate report on abnormalities; Wire log, test; Operator awareness, careful, regular weight check; Toolbox talk; Competence development, training; Standard of tools & equipment, maintenance; Compliance to procedure, limitation; Good communication; Good supervision; Lesson learned database, post job review; and Check list implementation.

This study also reveals 14 important factors for successful fishing operations. Those factors are: Complete and accurate history of fish, verified; Make sure all wire cleared out prior to latching on T/S; Tools & equipment availability; Fishing tools with releasing mechanism at all time; Proper planning covering all expected scenarios; Fishing specialist, more experienced, more skilful; Function/pressure test on tools & equipment; Sufficient time, no rush; Sufficient crew for long operations; Calm, be ready for any consequence; No blame cultures; Clear instruction, single source; Powerful unit; and Bigger wire.

REFERENCES

Aven, T., & Vinem, J. (2007). Risk management with applications from the offshore petroleum industry. London: Springer-Verlag.

Baumann, S., Erber, I., & Gattringer, M. (2016). Selection of Risk Identification Instruments. Journal of Finance and Risk Perspectives 5.2, 27-41.

Colton, S., & Hatcher, T. (2004). The Web-Based Delphi Research Technique as a Method for Content Validation in HRD and Adult Education Research. Academy of Human Resource Development International Conference (pp. 183-189). Austin: AHRD.

DeGeare, J. P. (2014). The Guide to Oilwell Fishing Operations, 2nd Edition. Gulf Professional Publishing. Journal of Sustainable Development 4(2): 16-32.

EHS Insight Resources. (2019). The Four Steps of Job Safety Analysis. Retrieved from https://www.ehsinsight.com/blog/the-four-steps-of-job-safety-analysis-jsa-examples

Giannarakis, G., Nikolaos, L. & Theotokas, I. (2011). A Delphi Study to Identify Corporate Social Responsibility Indicators: The Case of Greek Telecommunication Sector

Giannarou, L., & Zervas, E. (2014). Using Delphi technique to build consensus in practice. Int. Journal of Business Science and Applied Management, Volume 9, Issue 2, 66-82.

Gotay, J. A. (2020). A Classical Delphi Study to Identify the Barriers of Green Information Technologies. Open Science Journal 5(3).

Hefferan, M., & Wardner, P. (2012). New Firms---Od Assets: Using Delphi Technique to Identify Accommodation Priorities for Knowledge-intensive Firms. Journal of Corporate Real Estate, 14(4), 202-213.

International Organization for Standardization. (2019). Risk Management — Risk Assessment Techniques.

Jones, D., Day, J., & Quadri, D. (2013). Emerging Definitions of Boutique and Lifestyle Hotels: A Delphi Study. Journal of Travel & Tourism Marketing, 715-731.

Kim, J., Lee, Worlsook, L. & Lee, S. H. (2020), A Systematic Review of the Guidelines and Delphi Study for the Multifactorial Fall Risk Assessment of Community-Dwelling Elderly. International Journal of Environmental Research and Public Heath, 17(17), 6097.

Lamm, K. W., Randall, N. L., Diez-Gonzalez, F. (2020). Critical Food Safety Issues Facing the Food Industry: A Delphi Analysis. Journal of Food Protection.

Markmann, C., Darkow, I.-L., & von der Gracht, H. (2013). A Delphi-based risk analysis — Identifying and assessing future challenges for supply chain security in a multi-stakeholder environment. Technological Forecasting & Social Change, 1815-1833.

Nurek, M. Rayner, C., Freyer, A., Taylor, S., Järte, L., MacDermott, N., & Delaney, B. C. (2021). Recommendations for the Recognition, Diagnosis, and Management of Long COVID: a Delphi study British Journal of General Practice; 71 (712): e815-e825.

Occupational Safety and Health Administration. (2002). Job Hazard Analysis.

Post, A., Rannikmäe, M., & Holbrook, J. (2011). Stakeholder views on attributes of

scientific literacy important for future citizens and employees - a Delphi study. Science Education Journal Vol. 22, 202-217.

Proag, S. L., & Proag, V. (2014). A Framework of Risk Assessment. 4th International Conference on Building Resilience (pp. 206-213). Salford Quays: Elsevier B. V.

Renault, B., Agumba, J., & Ansary, N. (2016). A Theoretical Review of Risk Identification: Perspective of Construction Industry. Procs 5th Applied Research Conference in Africa (pp. 773-782). Cape Coast: ARCA.

Shi, C., Zhang, Y., Li, C., Li, P., & Zhu, H. (2020). Using the Delphi Method to Identify Risk Factors Contributing to Adverse Events in Residential Aged Care Facilities. Risk Management and Healthcare Policy. 4;13, 523-537.

Symanowitz, G. (2020, February). Why I banned Brainstorming. Finweek.

Trujillo, J.C, Vincent, J., & Robertson, N. (2010). Application of Heavy-duty Wireline Fishing Tools and Techniques Solves Complex Problem and Restores Well to Production. SPE/ICoTA Coiled Tubing and Well Intervention Conference and Exhibition. Texas: SPE.

van der Linde, H., Hofstad, C., van Limbeek, J., Postema, K., & Geertzen, J. (2005). Use of the Delphi Technique for developing national clinical guidelines for prescription of lower-limb prostheses. Journal of Rehabilitation Research & Development, 693-704.

Van de Linde, E., & van der Duin, P. (2011). The Delphi Method as Early Warning: Linking Global Societal Trends to Future Radicalization and Terrorism in The Netherlands. Technological Forecasting & Social Change. Vol. 78,9, 1557-1564.

van Valin, S. (2014, February). Brainstorming - here are the five rules. Retrieved from Leadership and Excellence.

Vinnem, J.-E. (2014). Offshore Risk Assessment Vol.1, 3rd Edition. London: Springer-Verlag.

Weatherford. (2003). Wireline Operations Manual. Weatherford.

